# COMPARISION OF DIFFERENT ALGORITHM FOR THE SEGMENTATION OF HANDWRITTEN INDIAN ANNOTATIONS

A THESIS SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENT FOR THE DEGREE OF

**BACHELOR OF TECHNOLOGY**

**In**

**BIO-MEDICAL ENGINEERING**

By

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Under the guidance of

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**Rourkela-769008**

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## CERTIFICATE

This is to certify that the thesis entitled, "**COMPARISON OF DIFFERENTALGORITHM FOR THE SEGMENTATION OF HINDIAN HANDWRITTEN ANNOTATIONS**" submitted by **BABY MAHESHWARI** in partial fulfilment for the requirements for the award of Bachelor of Technology Degree in Bio-Medical Engineering at National Institute of Technology, Rourkela (Deemed University) is an authentic work carried out by them under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other University / Institute for the award of any Degree or Diploma.

Dt: 11/05/2011

**Prof Sirsendu Sekhar Ray**

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# CONTENTS

# ABSTRACT

The thesis describe the application of segmentation on handwritten annotations on printed documents by various person which can be captured by simple camera or mobile phone. The procedure has three steps included to it such as segmentation, feature extraction and classifier. Existing studies propose a segmentation of annotation based on their form and function. Future prospects are feature extraction and classification using classifier which has wide application in forensic, hospital setup, handwriting recognition and newspaper reader. It has also seen that watershed algorithm (without using distance map and using variance filter) is best option available for segmentation of images.



Keywords : classifier, annotations, segmentations

# CHAPTER 1

# INTRODUCTION

## 1.1INTRODUCTION

In image processing, there are various problem occur, one of which is regarding segmentation which include pattern matching, image analysis and scene analysis. The project is on the segmentation of different pattern of handwriting written in different languages. Segmentation procedure is followed by feature extraction and classification done through classifier. Here, we mainly concentrated on segmentation. As character and handwriting recognition have various application for ex zip code reading, data acquisition checks etc. Increasing contrast and accentuates details in the selection of the image leads to the accentuation of noise. Of course in this project, we are mainly interested in the segmentation of handwritten words and we are not concerned by the semantic aspect but rather by the nature of present shape.it respond to several important issues like it help to recognize the style of handwriting and assign a unknown style to a class of coherent writing without having them read and having a large number of samples of object to classify.it has a valuable application in hospital like every time doctor written prescription is read by a person assigned for it and then he/she will feed it to the computer.it becomes more tedious when there are hundreds of prescription to be feeded on computer. So we tried if we'll be able to remove the intermediate or can it be possible that doctor written prescription can feeded to recognition software and it will recognize the data written for prescription by evaluating the standard data base already present on the system .after segmentation, it become necessary to look at the content analysis which involves extraction of low level characteristics from the shape occur in the words which further include feature extraction and classifier.

# CHAPTER-2

# MATERIALS AND METHODOLOGY

## 2.1 MATERIALS USED

- Image J
- Plugins
- Segmentation_ActiveMasks.jar

**Segmentation**

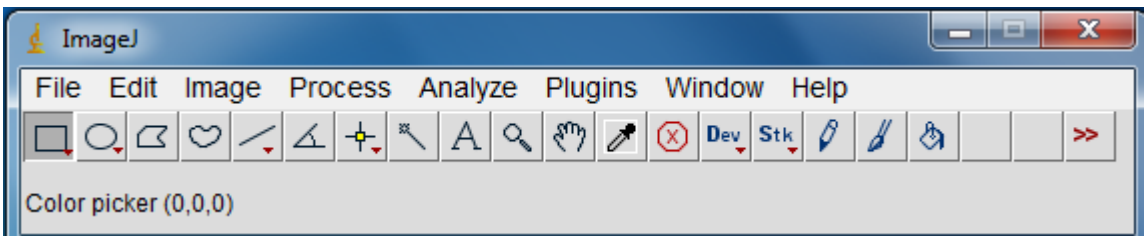
Watershed algorithm

Trainable segmentation

Level set algorithm

## 2.2 IMAGE J

Image J have Java source code and run in windows, Linux, MAC OSX etc. Image J is used for image processing. Image J can display, analyze, process, edit, save and print 8-bit, 16-bit and 32-bit images. Image J support image formats like JPEG,BMP,GIF,PNG etc. it provides multithreading so that various time consuming operations can be performed in parallel. Image J can calculate area and pixel value statistics of user-defined and intensity threshold objects. It also can measure angles, distances, create line profile plots and histogram.it support logical and arithmetical operations for contrast manipulations between images such as Fourier analysis smoothing ,median filtering , edge detection etc. It also performs rotation, flip and scaling as geometrical transformations.



### 2.3 INSTALLATIONS AND PLUGINS

Image J is free software available on the website

.

- The .jar files are needed to be downloaded to "C:\Image J\Plugins". Inside plugins folder all the plugins will be loaded in ImageJ.
- Whatever plugins loaded to the plugins folder will not appear unless the ImageJ will be restarted.
- One can easily found the plugins in Image J/plugins web page http://rsbweb.nih.gov/ij/plugins/
- http://rsb.info.nih.gov/ij/

## 2.4 Importing image Files

- We mainly use JPEG format files.
- By which a number of other file formats can be imported such as BMP, PNG, PGM.
- Other formats of files are accessible by File>Save As"
- Image>Adjust>Brightness-Contrast allow to adjust the brightness and contrast of the image opened and also helps in good image visualization.
- "Auto" applied to Image will adjust brightness and contrast of an image on the basis of histogram of the image.

- If this process is applied repeatedly, it will lead to saturation by gradually increasing the pixel percentage.
- For 8-bit image reset the “maximum “ and “minimum” value to 0 and 255

## 2.5 SEGMENTATION

In image processing, segmentation is the process of identifying objects in image. Segmentation refers to the process of partitioning an image into various multiple segments having pixels and super pixels sets.

First download segmentation_ActiveMasks.jar. In image J application folder, go to the plugins and copy the segmentation_ActiveMasks.jar file in it. The segmentation of an image is carried out by opening an image from file and then applying various parameters into it by using the interactive tool and then run the segmentation algorithm. After the segmentation process is over, the output image or the result have to be saved in file.

Segmentations are of different types such as

a) Trainable segmentation
b) Watershed algorithm
c) Level-set algorithm

### 2.5.1 TRAINABLE SEGMENTATION

Trainable segmentation is a very useful method for segmenting complex images

- Go to the plugins -→ segmentation→trainable segmentation. Before doing this choose two samples.
- After the application of trainable segmentation.

- Scribble the dark portion of image and add to class 1.
- Again scribble the light portion of image and add to class 2.
- Separate other portion of the image which is unnecessary or just separate by drawing boundary lines so that region of interest would be more prominent.
- Add those to a new class name it new.
- After following all these procedure .there will be train classifier option on the left hand side of page opened. Click on train classifier.
- The result will be created.
- To create more clarifying image click the box create result.
- By clicking on "Toggle Overlay" one can see the image clearly.
- Adjust the feature using the "Setting" button.

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### 2.5.2 WATERSHED ALGORITHM

Watershed algorithm is a type of image segmentation based on morphology. For watershed transformation, the topographic surface is the gradient magnitude of an image. There are many ways of finding watershed lines. Good estimation of image gradient relies mostly on complete division of the image with watershed transformation. The background noise leads to the degradation of result of the watershed transformation and produces over-segmentation. Also low contrast edge results in distinct region which are erroneously merged also develop small magnitude gradient and produce under segmentation. Watershed transformation has application in traffic monitoring, coffee bean separation, silver grains on a photographic plate. A drop of water fall downs until it reaches the bottom. The idea says that with the help of minima point, we can determine region and boundary.

In image processing, grayscale picture have numerous advantages as it considered as topographic reliefs. The elevation at this point is corresponds to the numerical value of each pixel. One problem is that in these the necessary process is de-noising process because all edges and noise appear in image gradient and produces over-segmentation. Without blurring the edge, noise removal in image analysis is difficult. Moreover, noises are of high spatial frequencies. Fourier transform can be applied to suppress the high frequencies component but it reduces the sharpness of edge therefore it is not suitable.

### 2.5.5 LEVEL SET ALGORITHM

Level set algorithm can be divided into 2 types

A) Fast marching

b) Active contour

Level set technique is one of the image segmentation technique based on partial difference equation (PDE). To find boundaries of the objects, the difference among neighbouring pixels is evaluated. As the algorithm are set like that it will converge at the boundary of the object where the difference are high.

Fast marching and advanced active contour algorithm is two PDE based method in Fiji plugin. Fast marching is like standard flood fill and sensitive in boundary detection.as the region is growing it calculates continuously the difference of current selection set of pixel value to the newly added pixels and stop when it exceed a preselected gray value difference.

**ALGORITHM DETAILS**

Active contours develop an initial contour w.r.t. time by measuring multiple intrinsic geometric of the image. In this plugins implementation measurement are based on edge constraint. The grey value penalty as well as curvature constraint prevents leaking of the

object boundary at areas of poor edges. The Active Contour split and merge to detect even multiple objects during curve evolution.

**Parameters**

The "Pre-processing option" calculates the difference of neighbouring pixels.

**FAST MARCHING**

- Gray value threshold

  The gray value difference between boundary pixels and seed point are progressively increasing, this is used to determine the stopping point in expansion.

  For image of stronger contrast, the value will increase.

  For the image having no contrast, the value will be decreased.

- Distance threshold

  It determines the extent of expansion in one iteration as permitted by selection.

  It signifies the speed the contour progresses.

  Increase the value for speeding up the segmentation.

  Although it may advance too fast and miss the boundary

**LEVEL SET PARAMETERS**

- Advection

  It signifies the speed of contour progress.

- Propagation

The propagation of the contour is determined by this number.

- Curvature

  While progressing the contour, it determine weight of the curvature.

- Gray scale tolerance

  The gray value of the current contour is compared with next contour in progression. It all occur during contour evolution.

- Convergence

  Set a value here for converging. Between two iteration if the change in the contour are lower than set value, it lead to stoppage of algorithms.

  The value increases when contour doesn't stop at boundary get collapsed completely and the value decreases if the contour stop too easily.

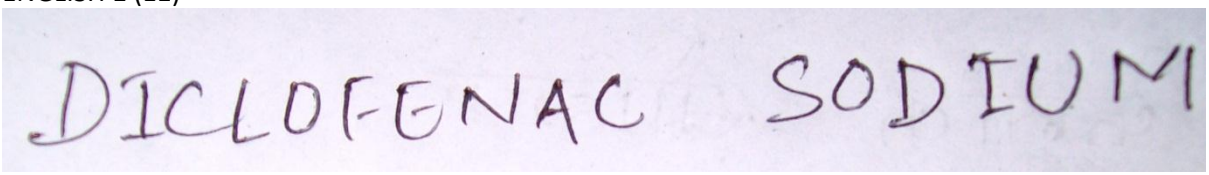
- Region expand

  It determines the contour will evolve outside or inside of the selection area.

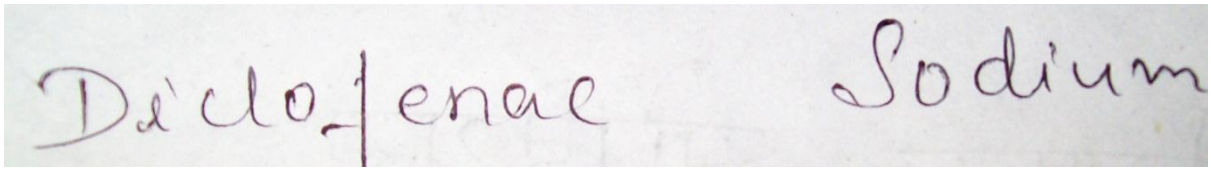
## METHODLOGY

The images taken for segmentation from Sony Cybershot (12 MP, 4X OPTICAL ZOOM) from three different people in three different languages( English, Hindi, Oriya) are as follows

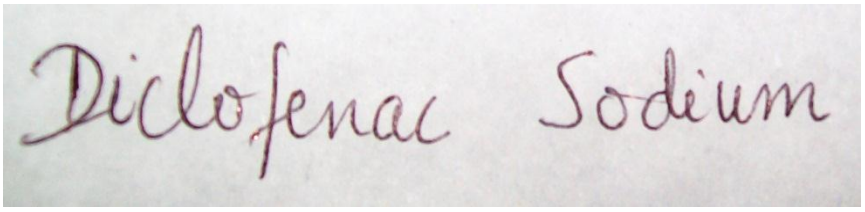
ENGLISH 1 (E1)



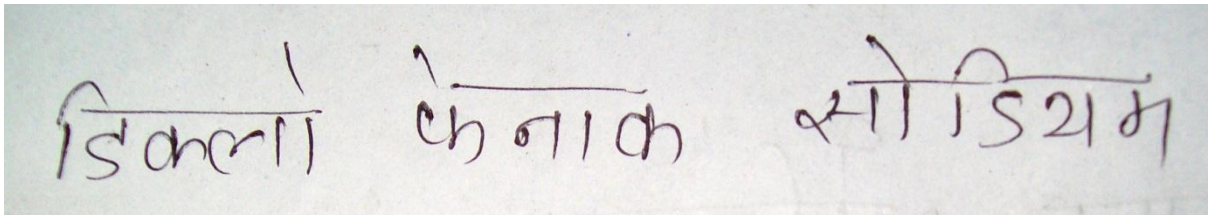

ENGLISH 2 (E2)



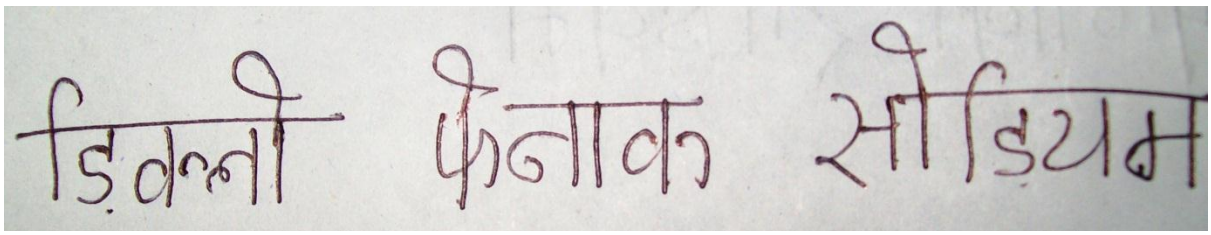
ENGLISH 3 (E3)



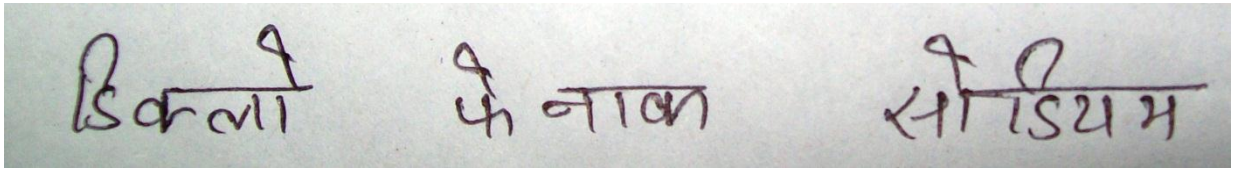
HINDI 1 (H1)



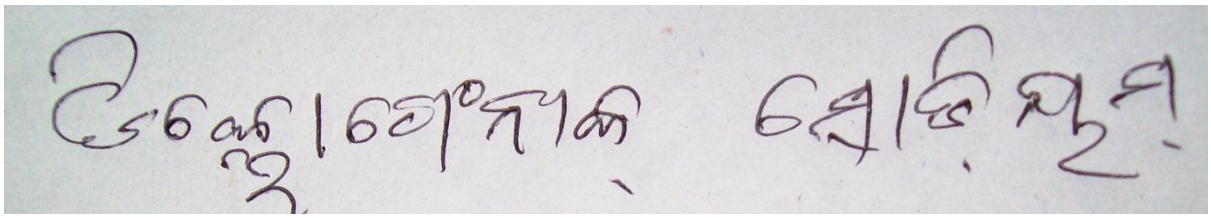
HINDI 2 (H2)



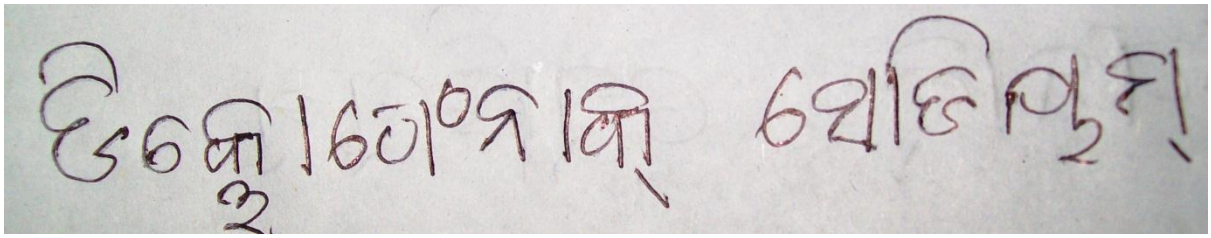
HINDI 3 (H3)



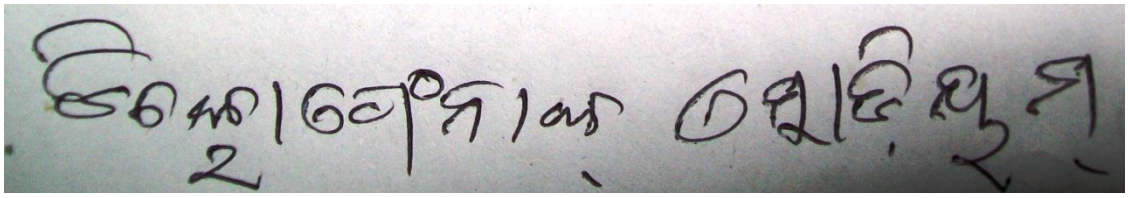
**ORIYA 1( O1)**



**ORIYA 2 (O2)**



ORIYA 3 (O3)



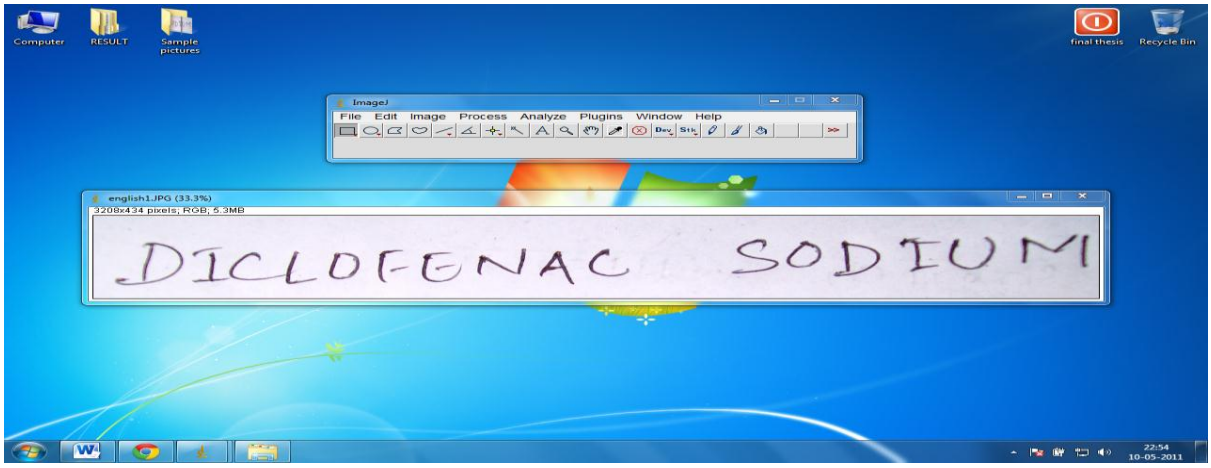
After that different segmentation procedures are applied on the above images and results are shown in this next chapter.

# CHAPTER 3

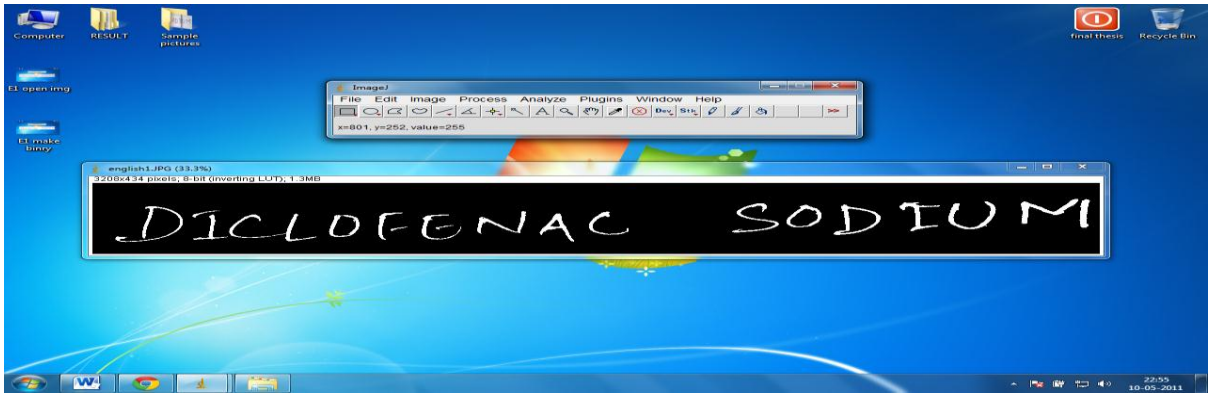
# RESULTS AND DISCUSSIONS

## 3.1 WATERSHED ALGORITH ON E1

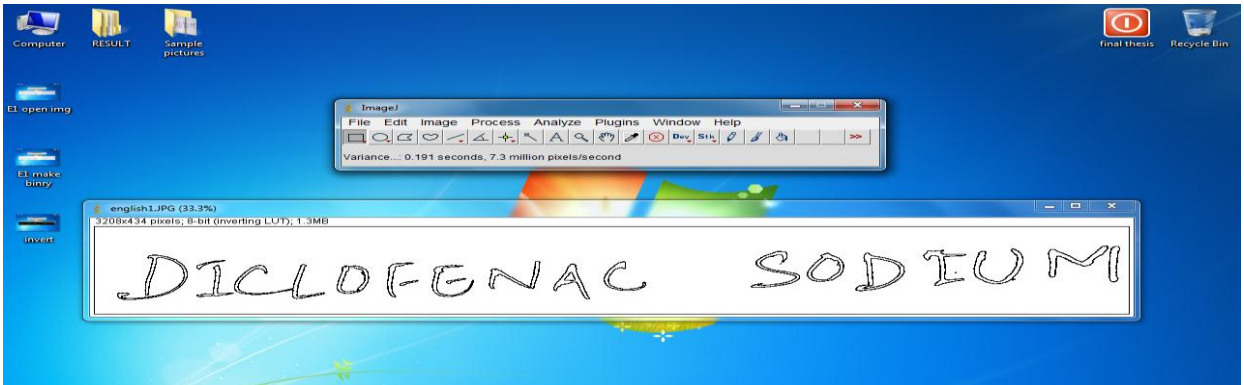
**Step 1: Open image E1**



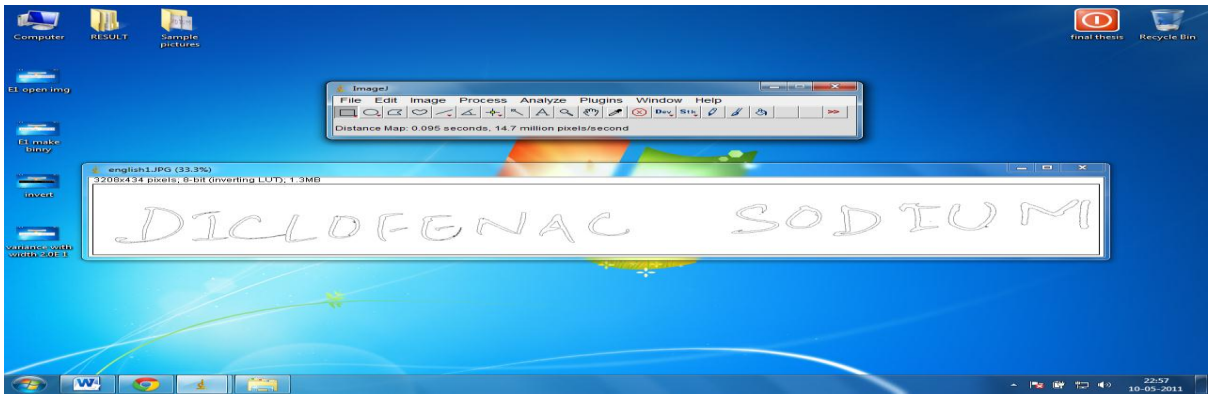

**Step** 2: Make binary



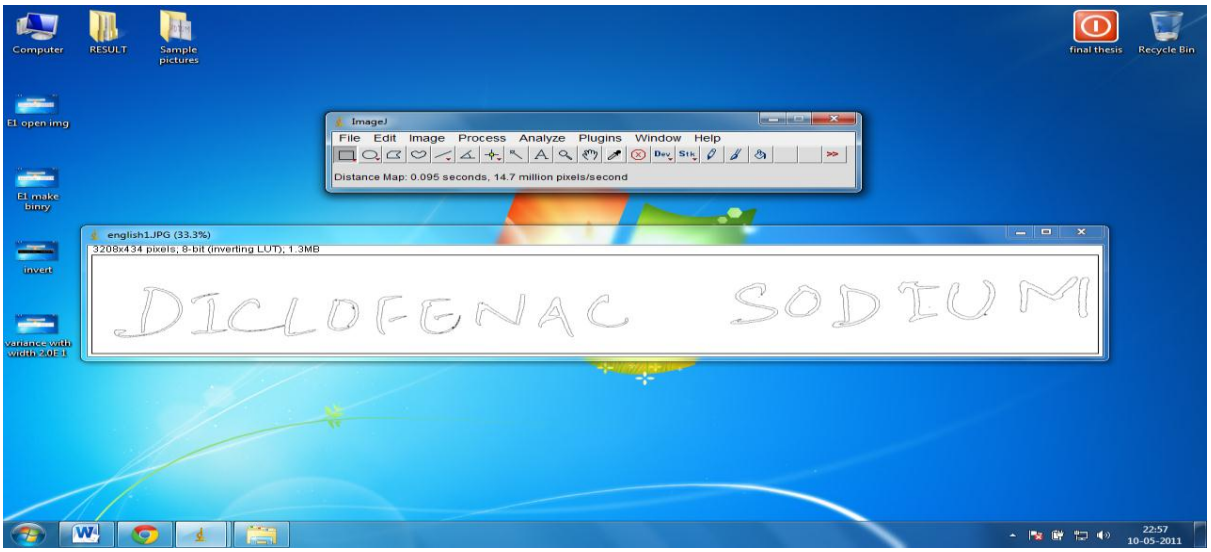

Tep 3: Invert image



Step 4: apply variance filter



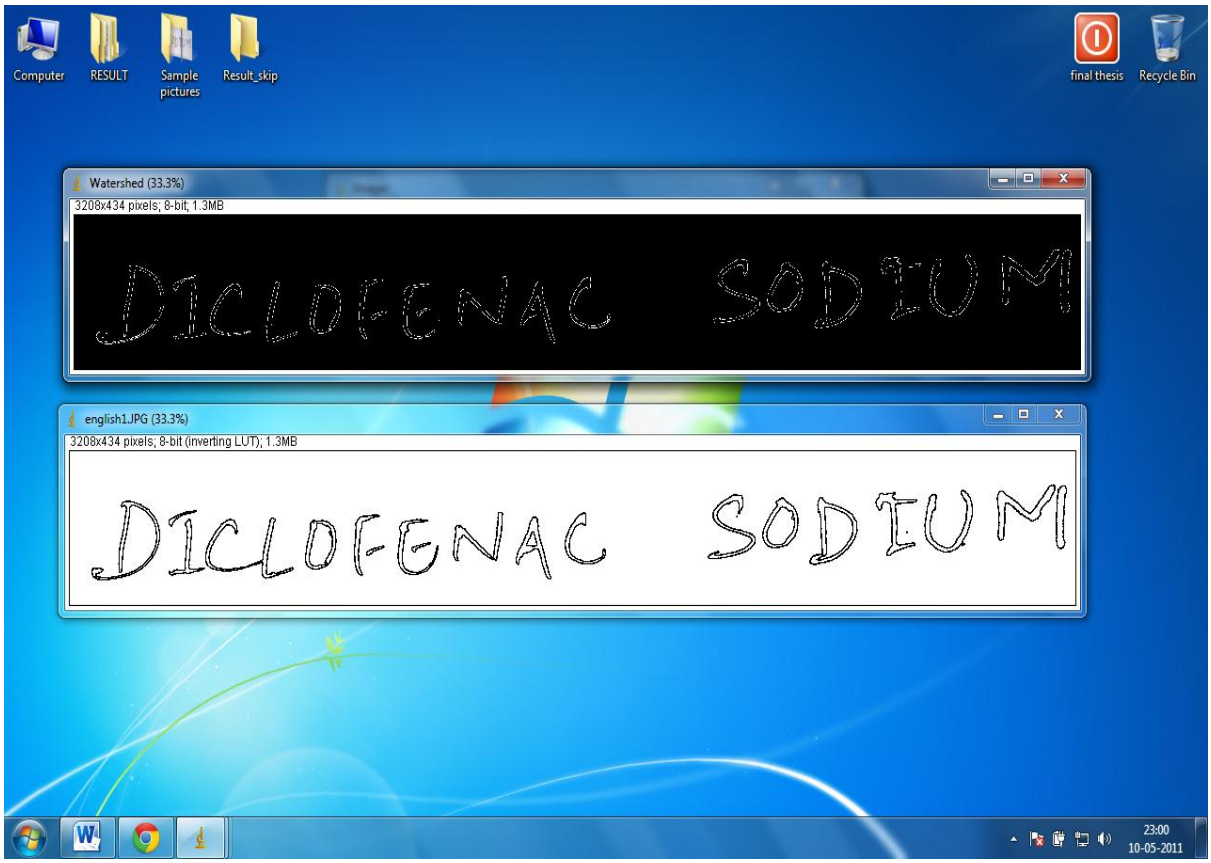

Step 5: Apply ditance map



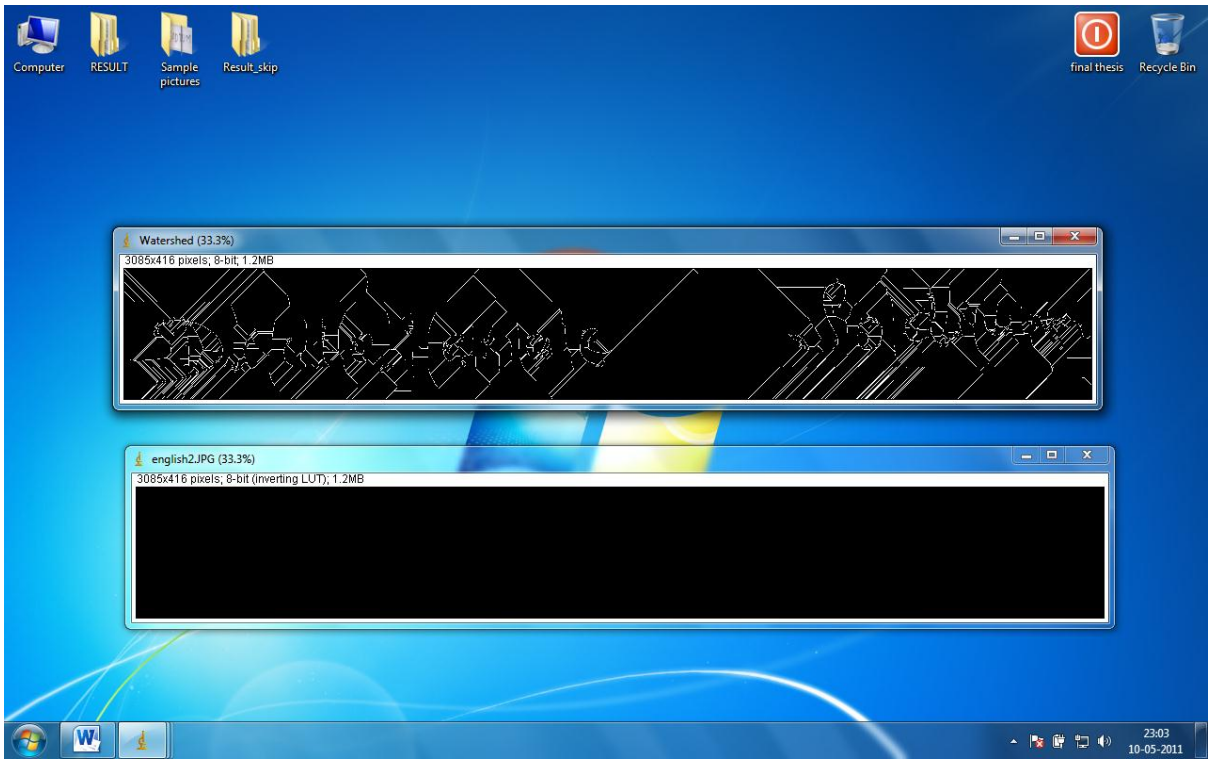

Step 6: invert result

Step 7: watershed result of E

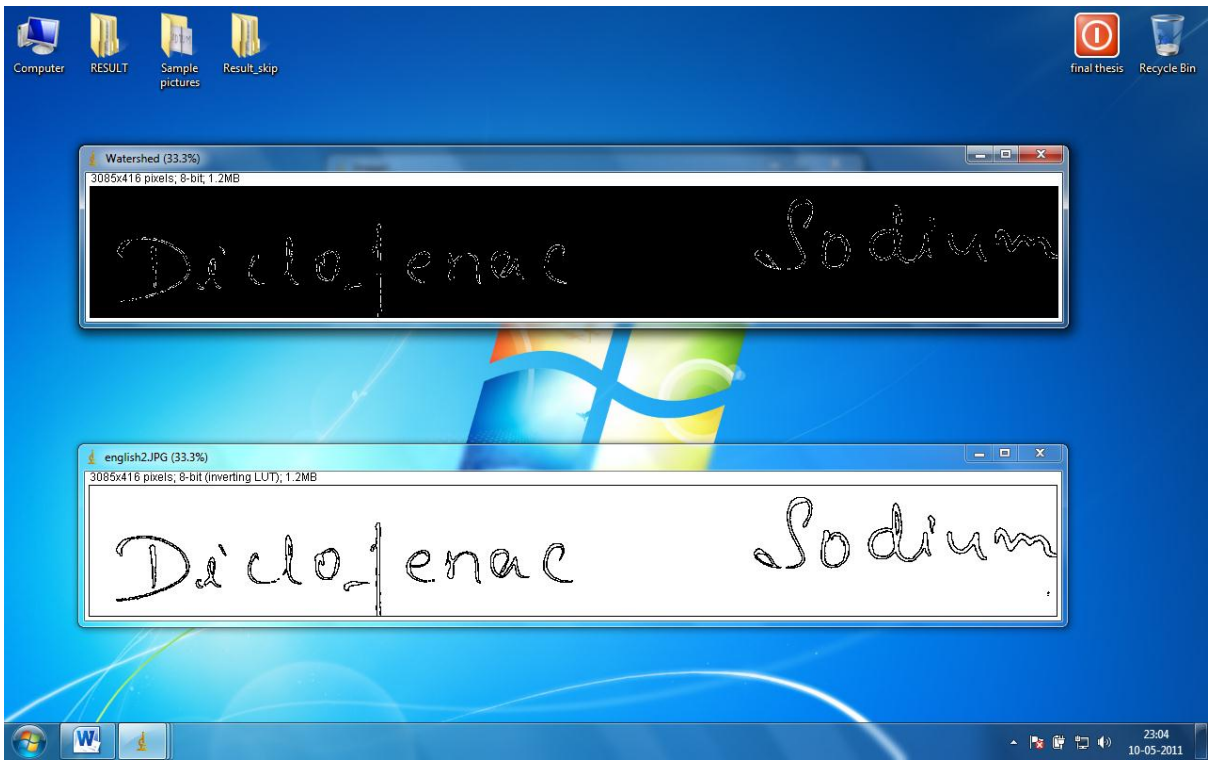
WATERSHED RESULT OF E1+ VARIANCE FILTER ( WITHOUT DSITANCE MAP)



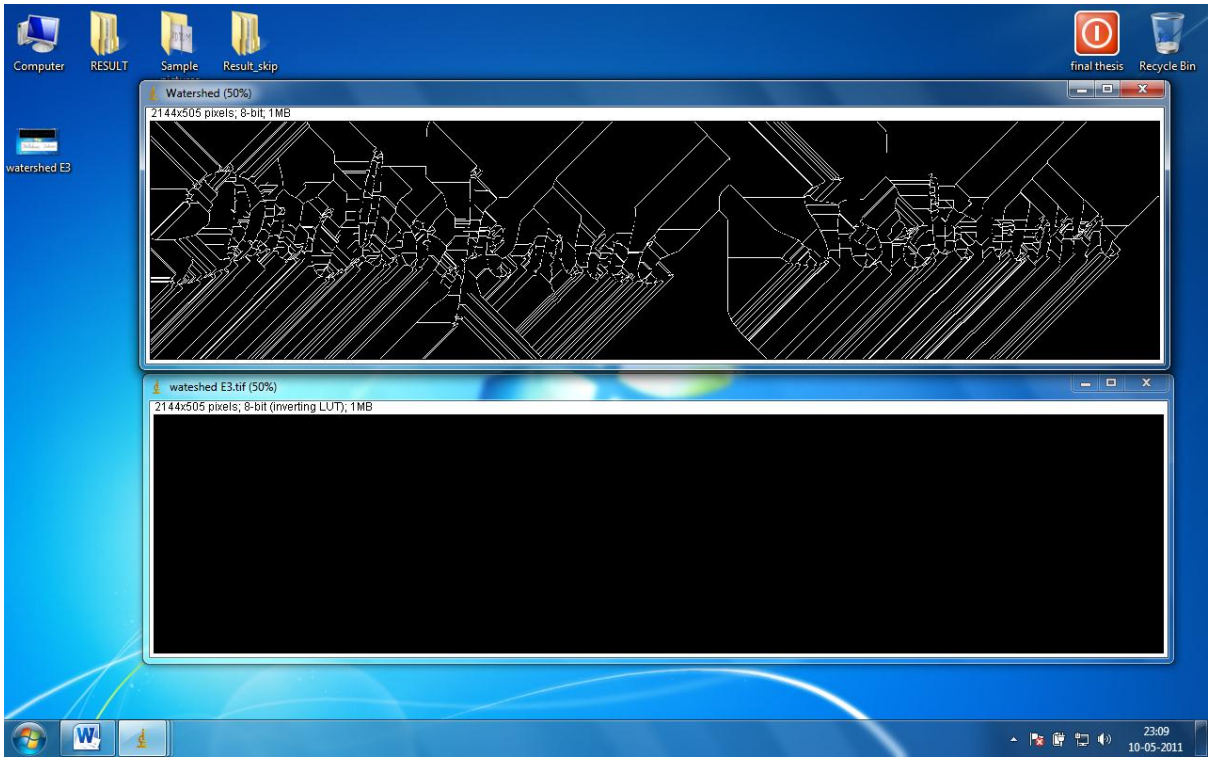
WATERSHED RESULT OF E2+ VARIANCE FILTER ( WITH DISTANC MAP)




WATERSHED OF E2 +VARIANC FILTER (WITHOUT DISTANCE MAP)

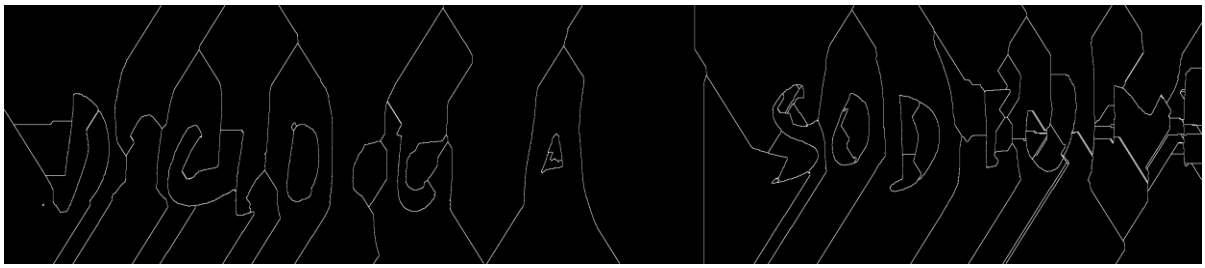



WATERSHED OF E3+VARIANCE FILTEER(WITH DISTANCE MAP)

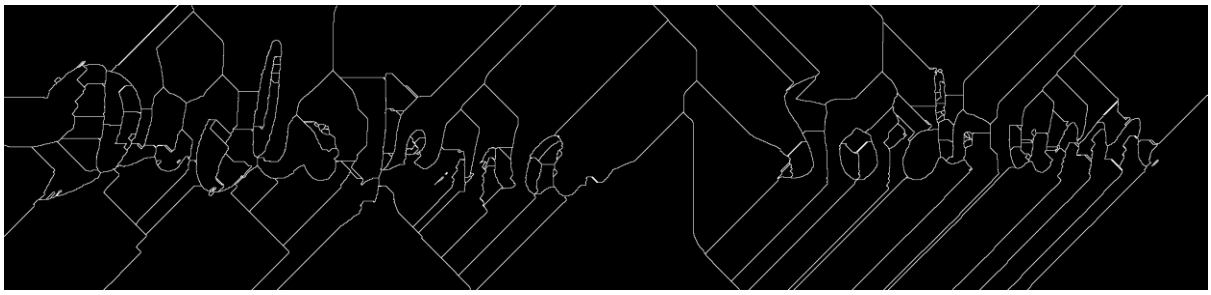



WATERSHED OF E3+VARIANCE FILTER (WIT HOUT DISTANCE MAP)

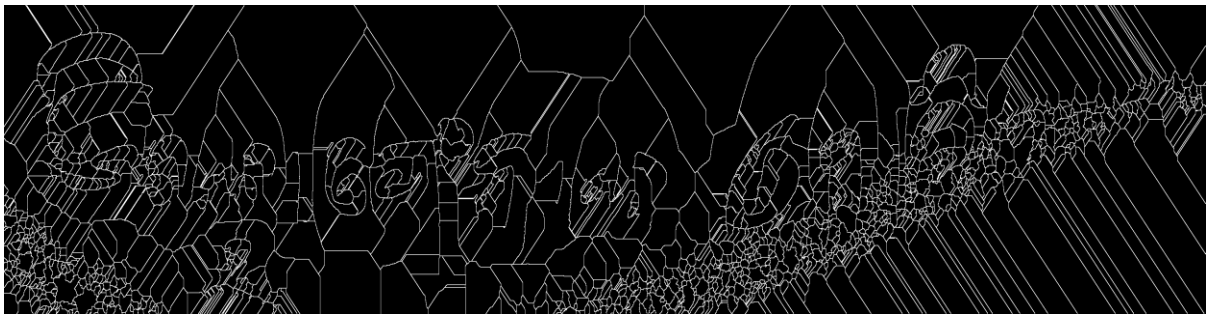
CONVOLV FILTER+WITH DISTANCE MAP+WATERSHED OF E1



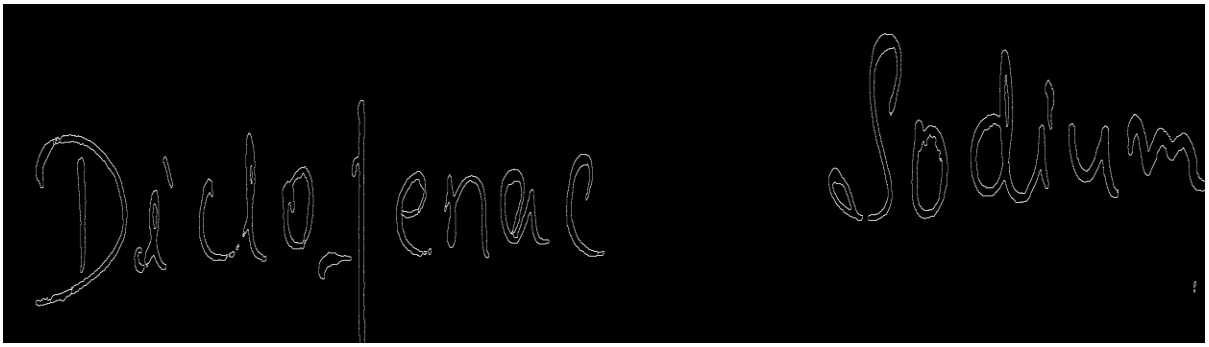
CONVOLV FILTER+WITH DISTANCE MAP+WATERSHED OF E3



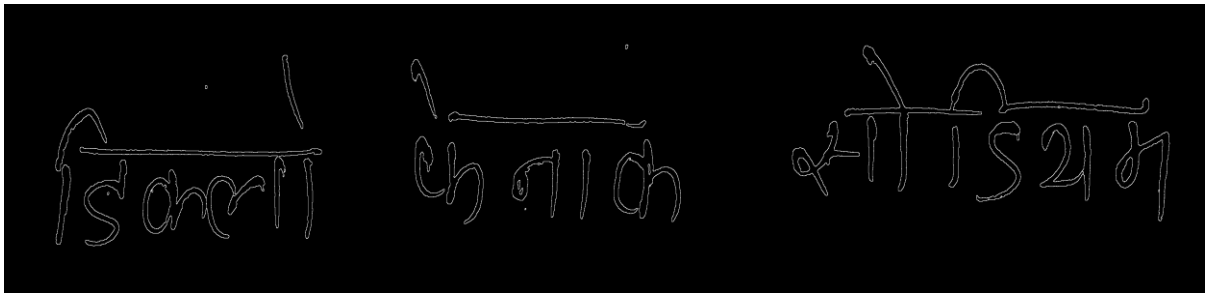
CONVOLV FILTER+WITH DISTANCE MAP+WATERSHED OF O3



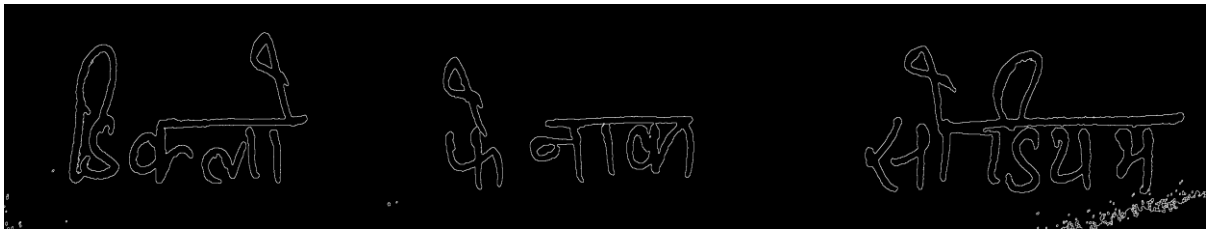
CONVOLV FILTER+WITH OUT DISTANCE MAP+WATERSHED OF E1



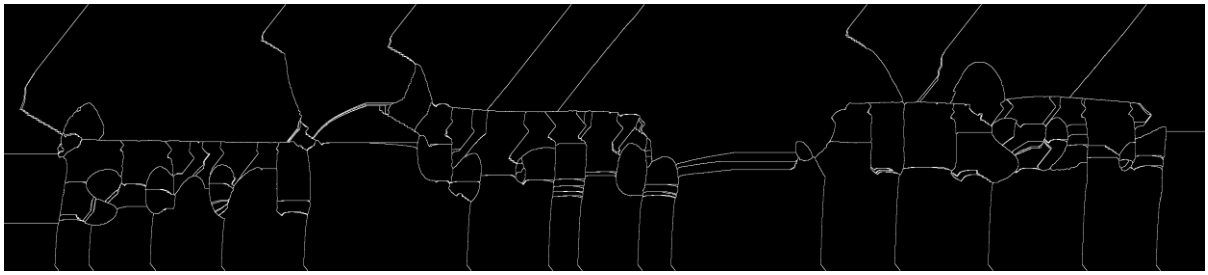
CONVOLV FILTER+WITH OUT DISTANCE MAP+WATERSHED OF H1



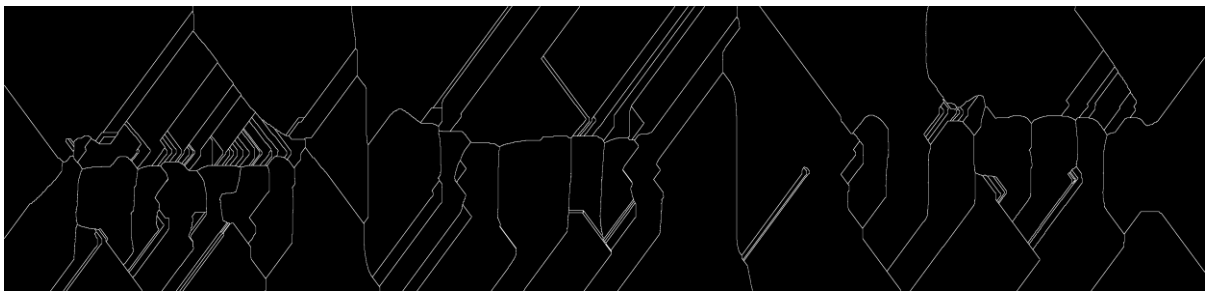
CONVOLV FILTER+WITH OUT DISTANCE MAP+WATERSHED OF H3



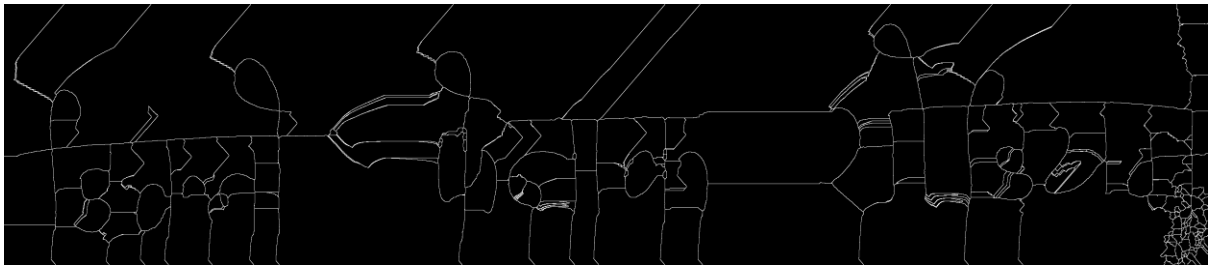
MAXIMUM FILTER+WITH DISTANCE MAP+WATERSHED OF H1



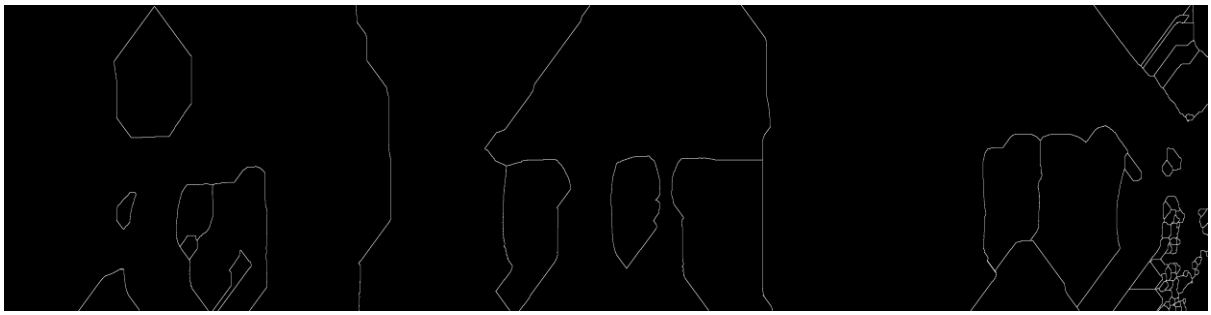
MAXIMUM FILTER+WITH OUT DISTANCE MAP+WATERSHED OF H1



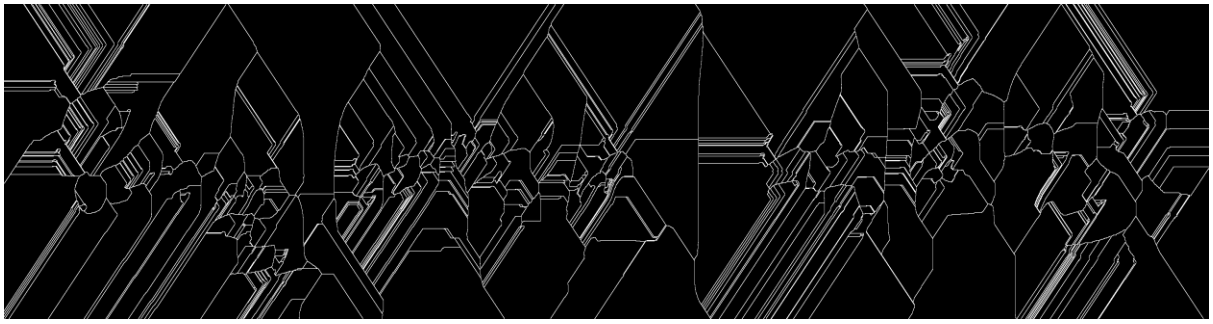
MINIMUM FILTER+WITH DISTANCE MAP+WATERSHED OF H2



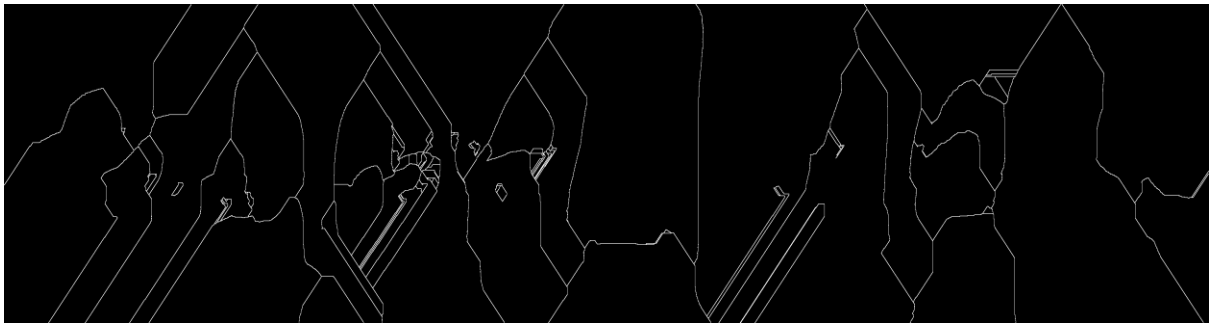
MINIMUM  FILTER+WITH OUT DISTANCE MAP+WATERSHED OF H2



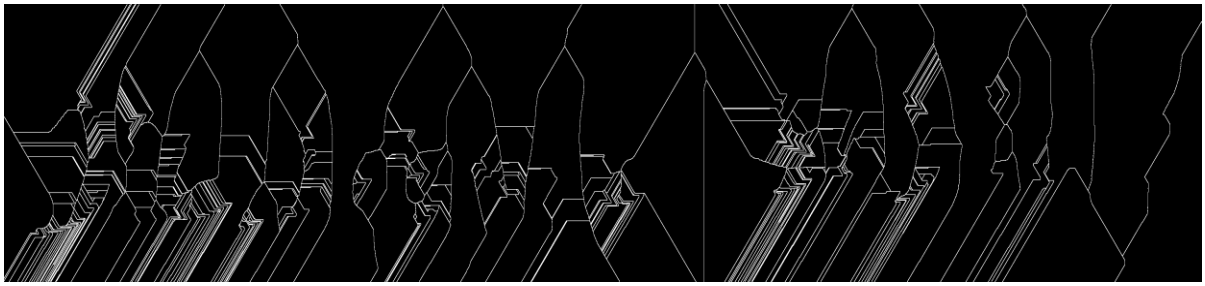
MEAN FILTER+WITH  DISTANCE MAP+WATERSHED OF O1



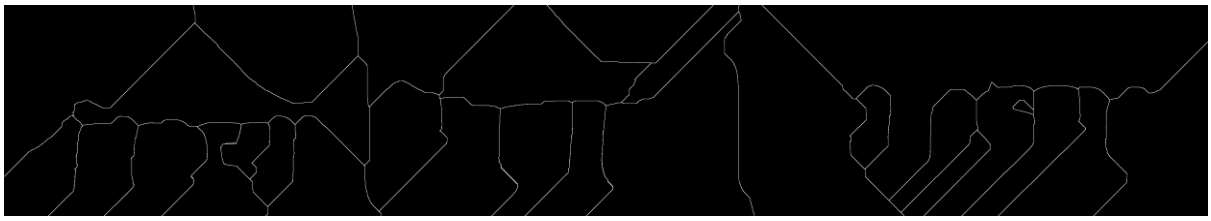
MEAN FILTER+WITH OUT DISTANCE MAP+WATERSHED OF O1



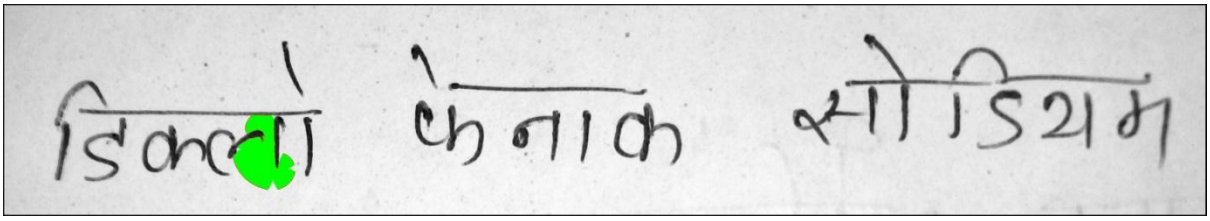
GAUSSIAN BLUR  FILTER+WITH OUT DISTANCE MAP+WATERSHED OF E1

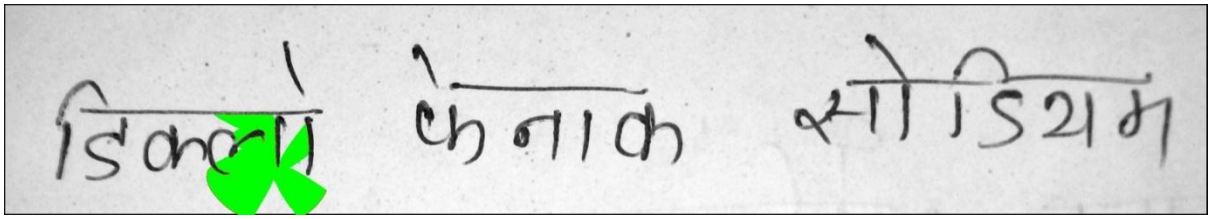


MEDIAN FILTER+WITH OUT DISTANCE MAP+WATERSHED OF H1



## 3.2 LEVEL SET ALGORITHM RESULTS

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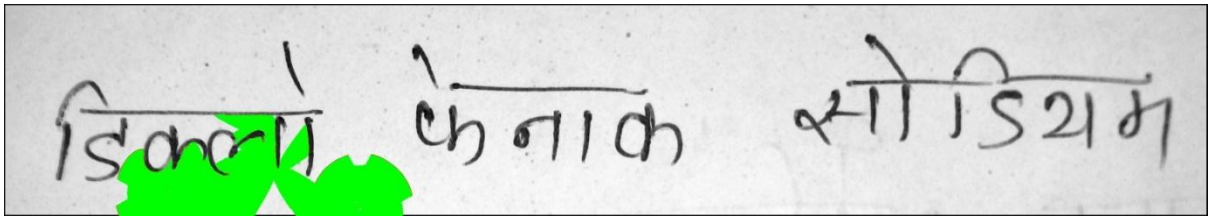
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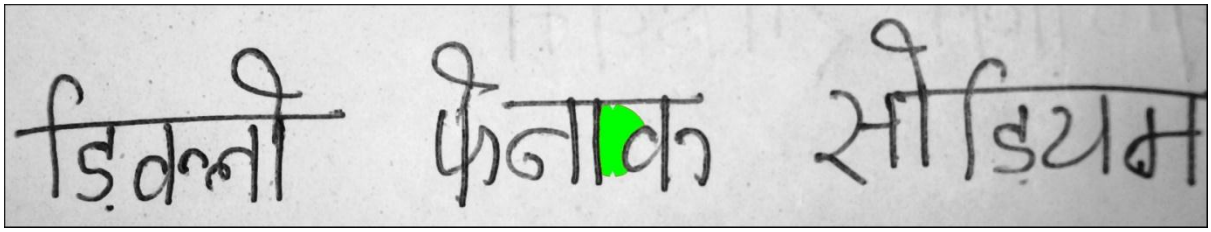
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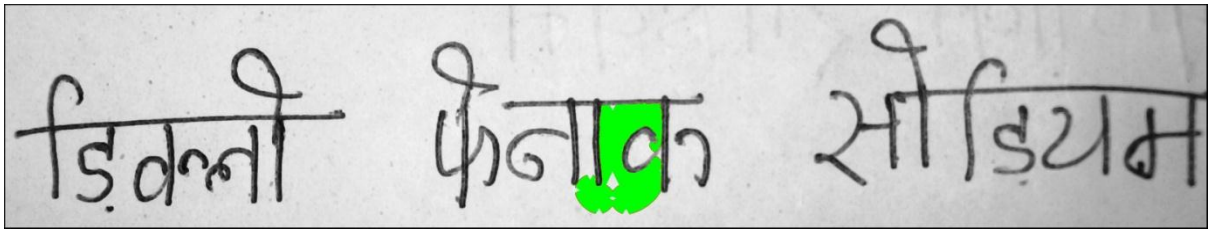
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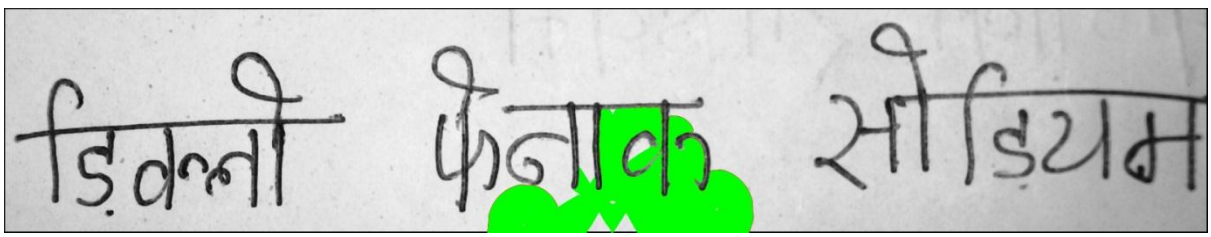
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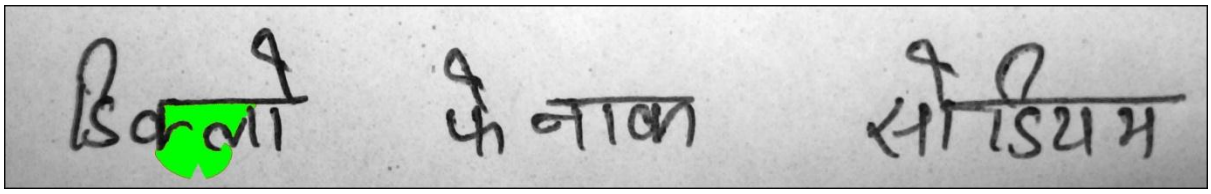
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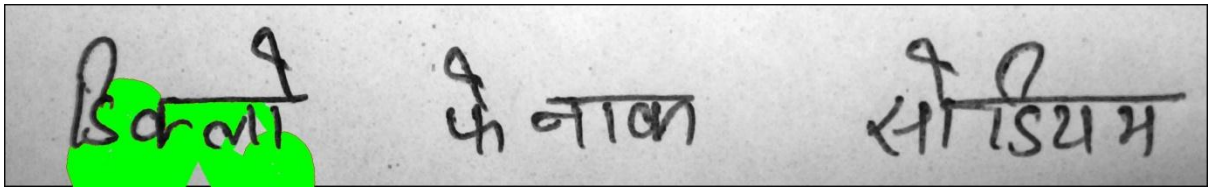
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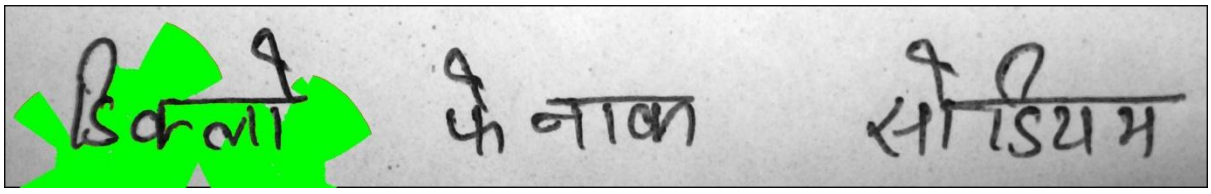
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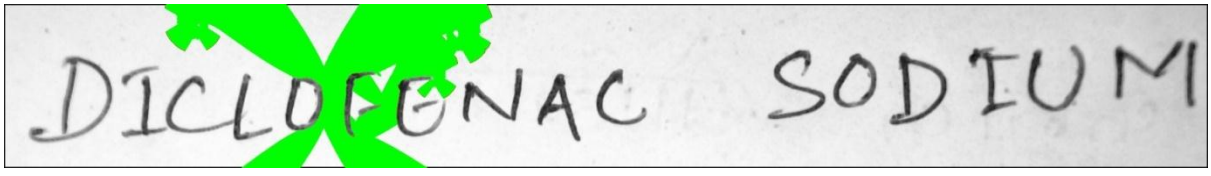
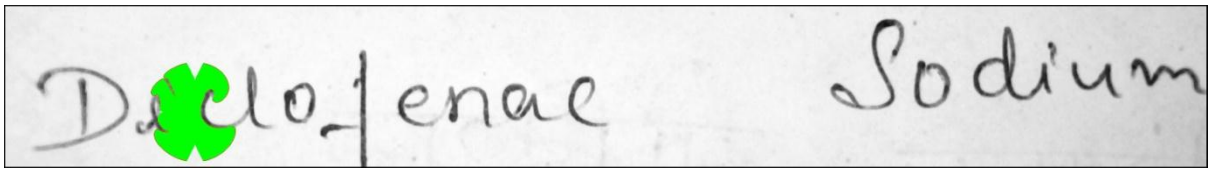

DICLOFENAC SODIUM


DICLOFENAC SODIUM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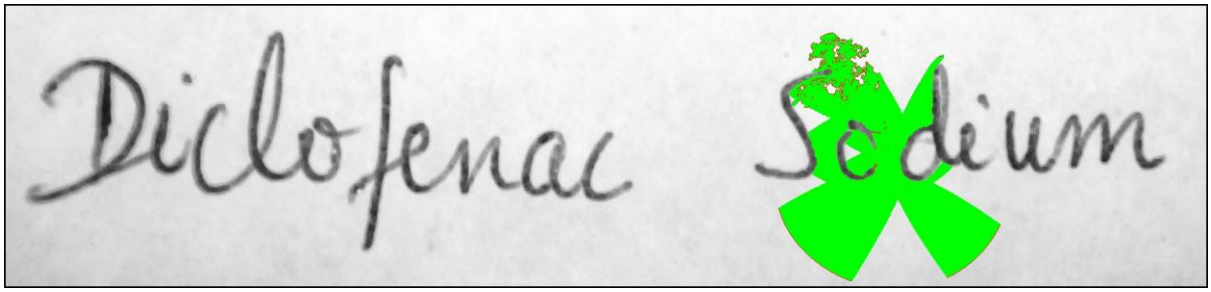
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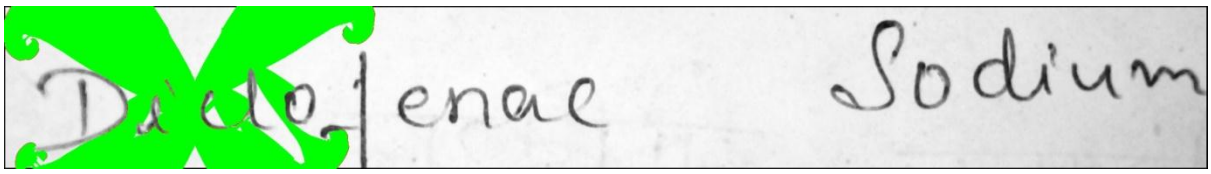
Sodium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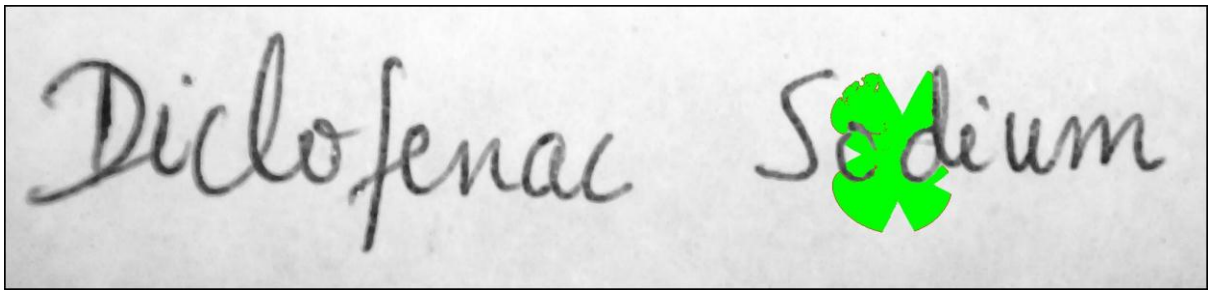
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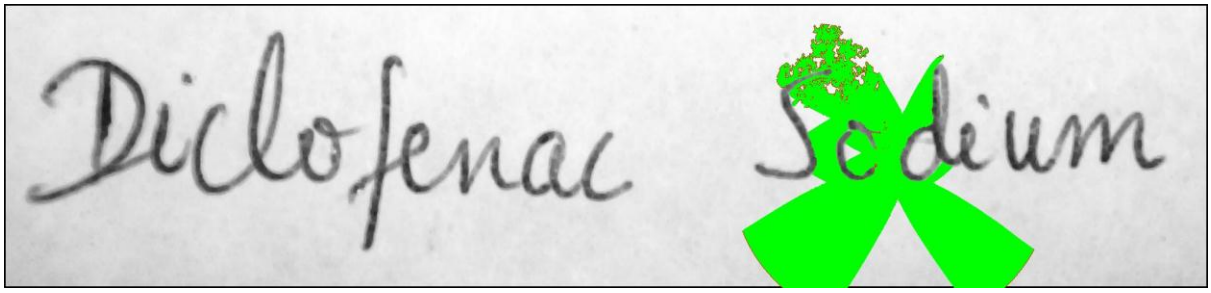
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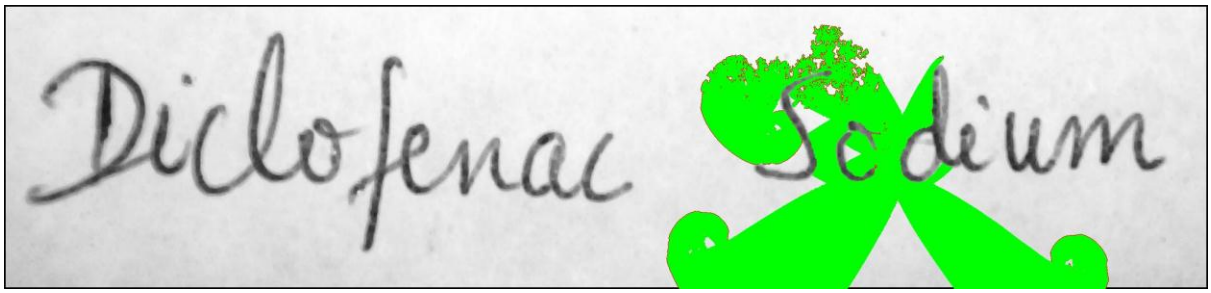
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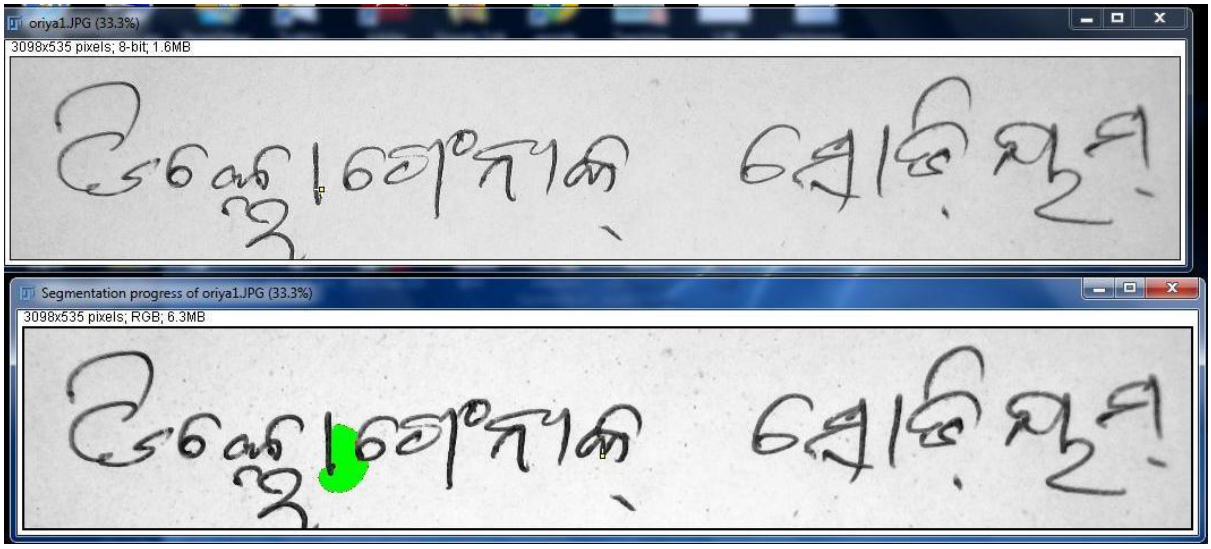
Sodium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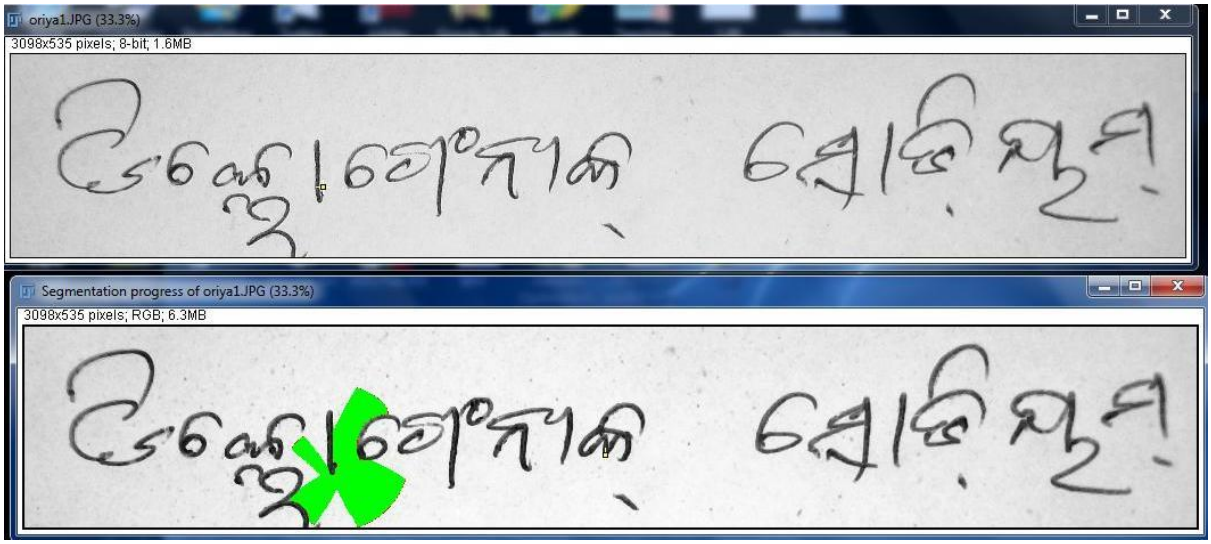
Segmentation progress of oriya1.JPG (33.3%)
3098x535 pixels; RGB; 6.3MB


oriya1.JPG (33.3%)
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Segmentation progress of oriya1.JPG (33.3%)
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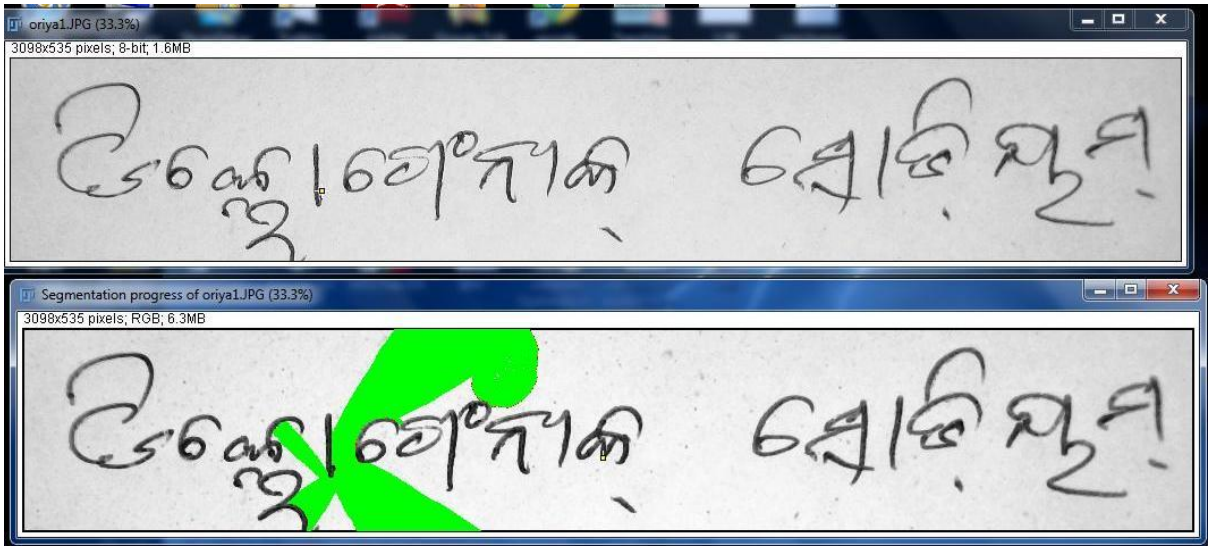
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Segmentation progress of oriya1.JPG (33.3%)
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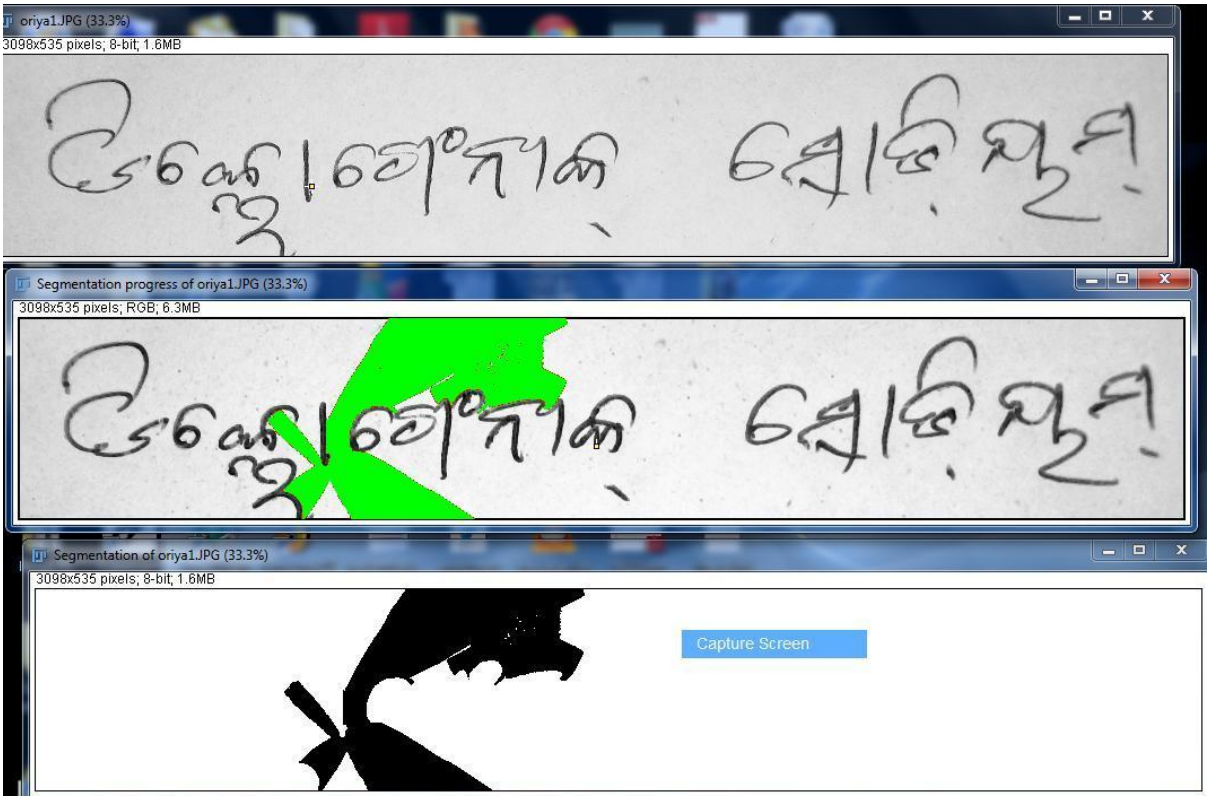
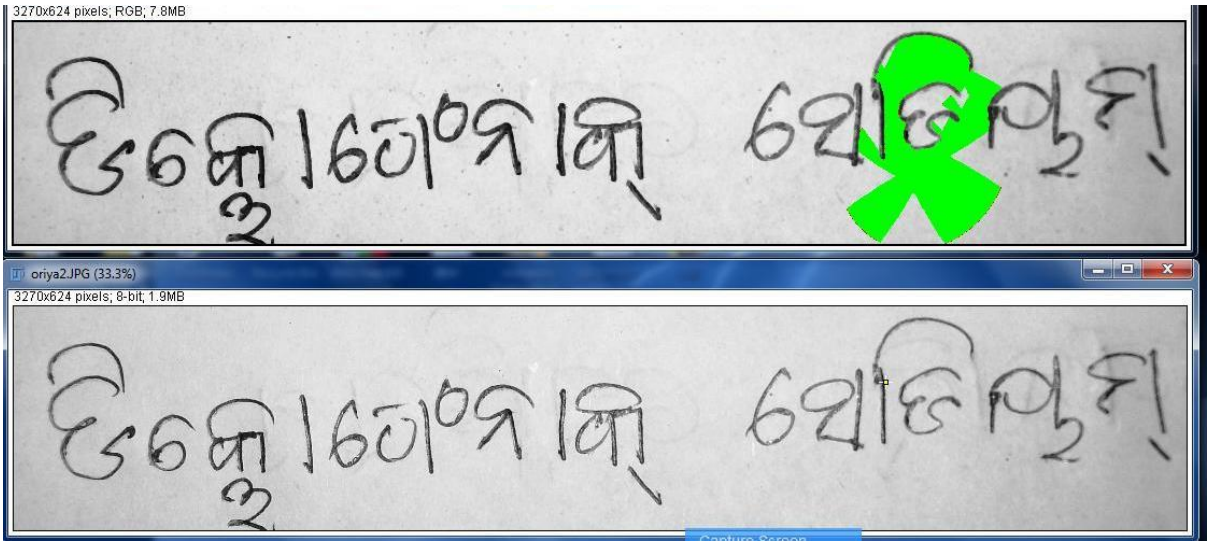

oriya1.JPG (33.3%)
3098x535 pixels; 8-bit; 1.6MB
Segmentation progress of oriya1.JPG (33.3%)
3098x535 pixels; RGB; 6.3MB
Segmentation of oriya1.JPG (33.3%)
3098x535 pixels; 8-bit; 1.6MB
Capture Screen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oriya2.JPG (33.3%)
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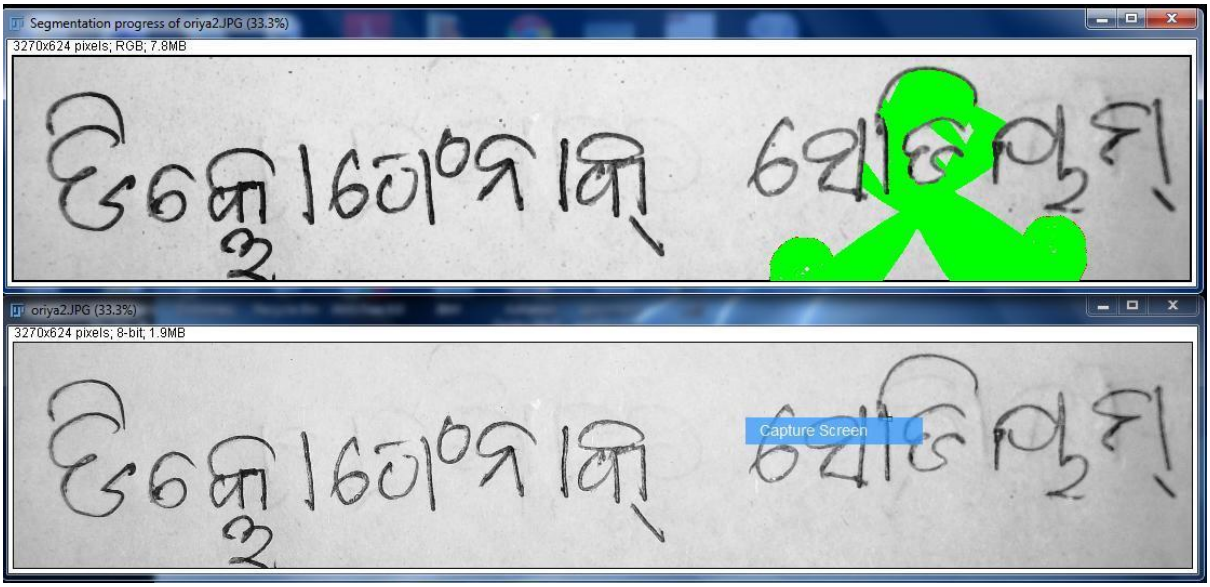
Segmentation progress of oriya2.JPG (33.3%)
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oriya2.JPG (33.3%)
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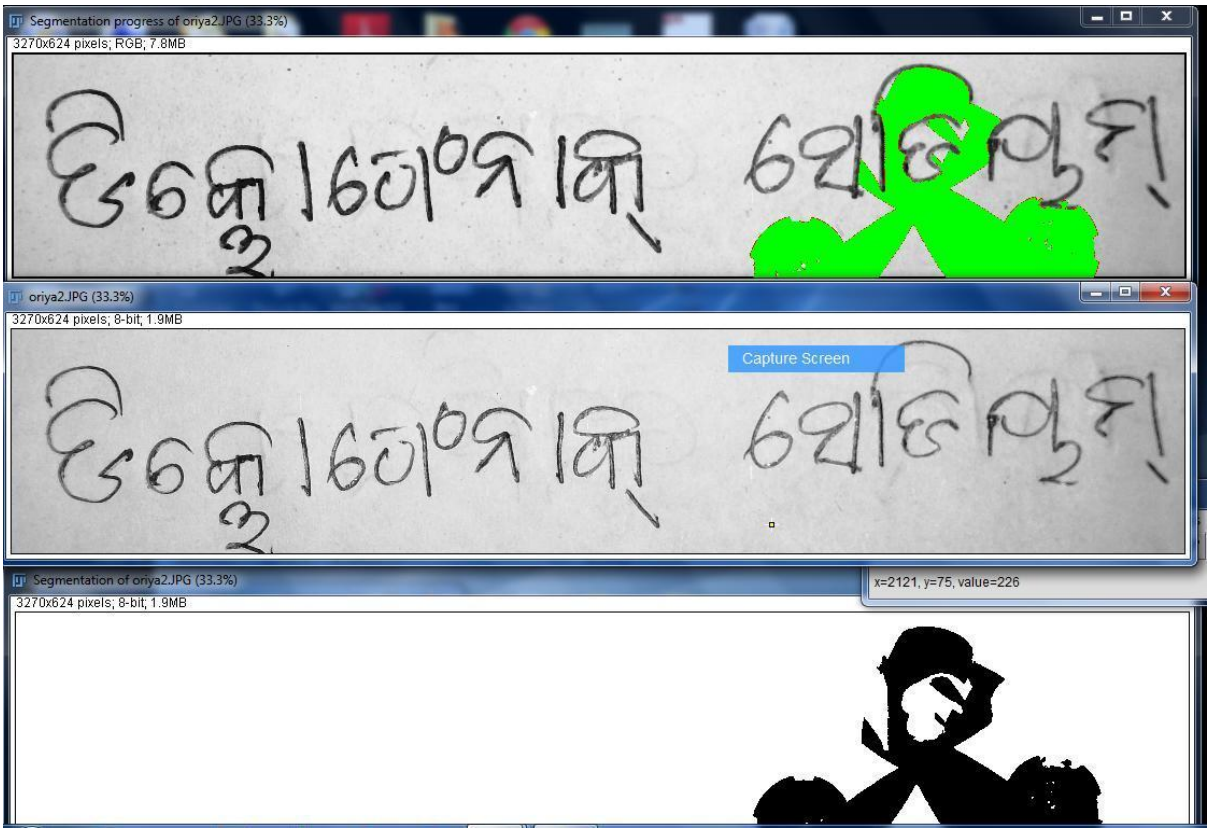
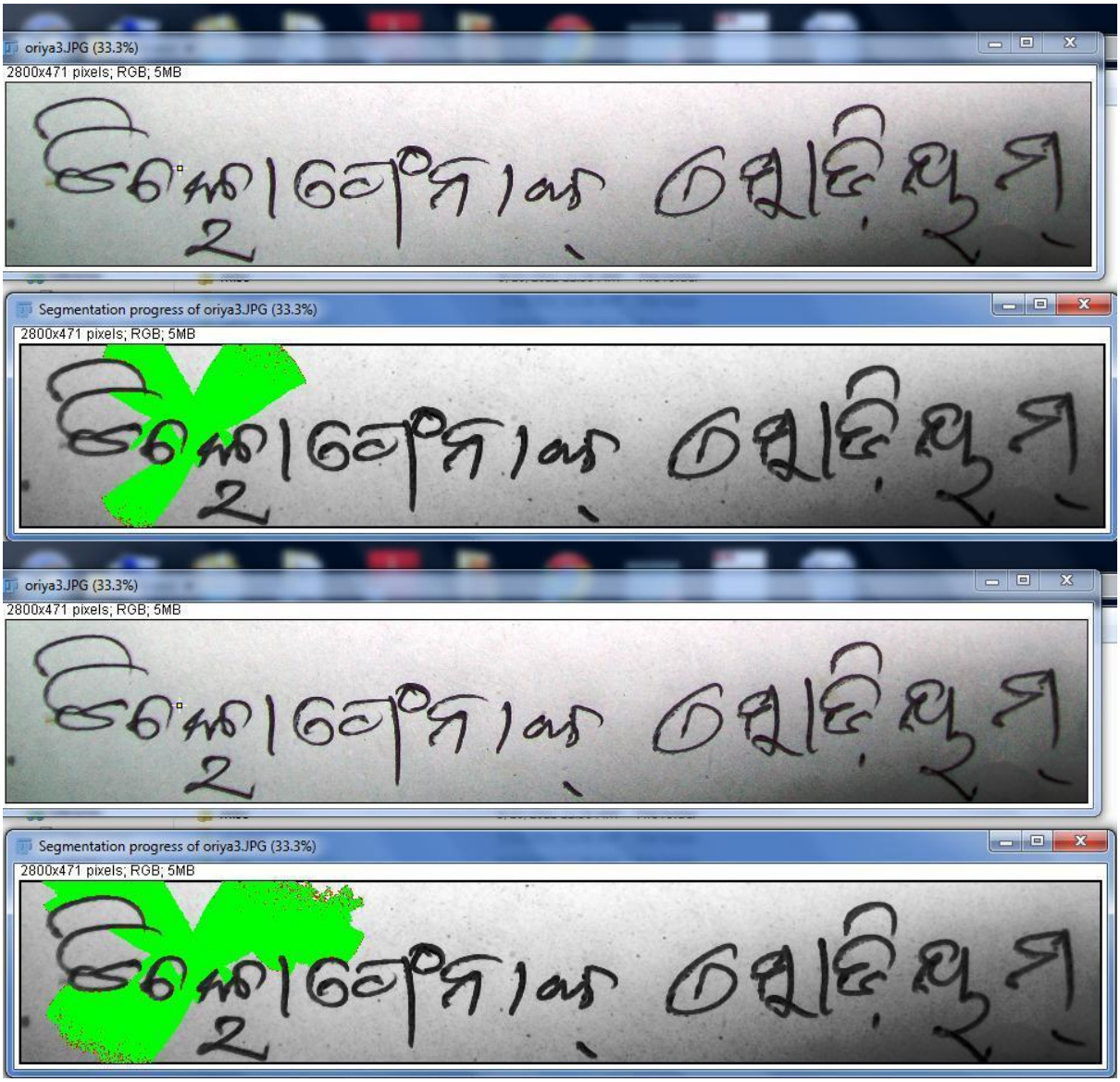
Capture Screen


Segmentation progress of oriya2.JPG (33.3%)
3270x624 pixels; RGB; 7.8MB
oriya2.JPG (33.3%)
3270x624 pixels; 8-bit; 1.9MB
Capture Screen
Segmentation of oriya2.JPG (33.3%)
3270x624 pixels; 8-bit; 1.9MB
x=2121, y=75, value=226


oriya3.JPG (33.3%)
2800x471 pixels; RGB; 5MB
Segmentation progress of oriya3.JPG (33.3%)
2800x471 pixels; RGB; 5MB
oriya3.JPG (33.3%)
2800x471 pixels; RGB; 5MB
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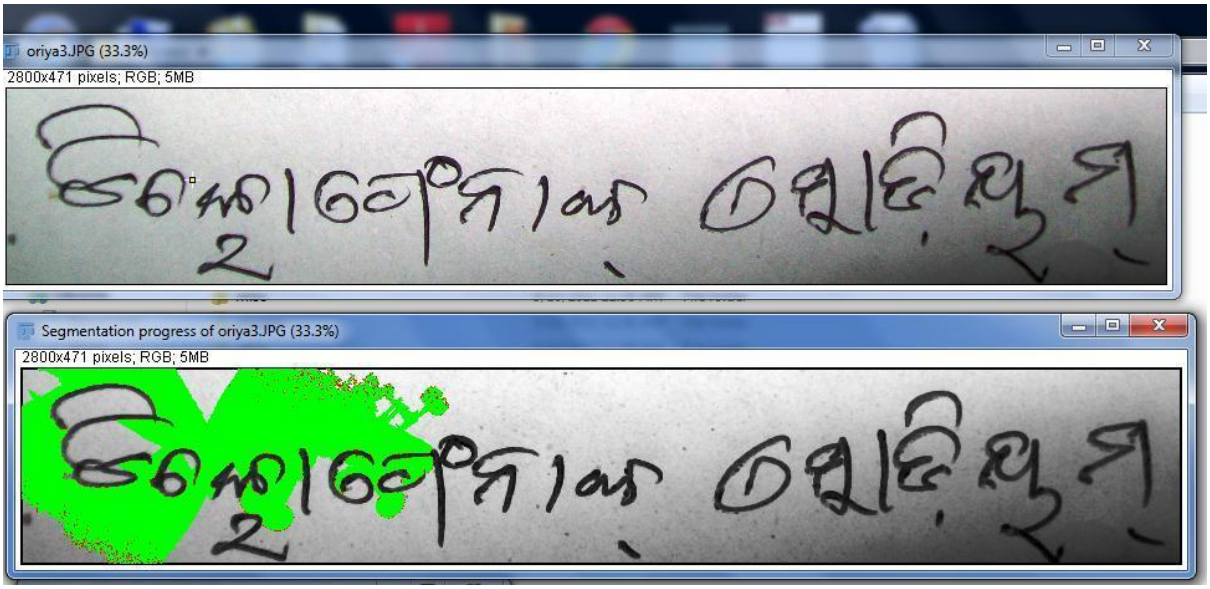
oriya3.JPG (33.3%)
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Segmentation progress of oriya3.JPG (33.3%)
2800x471 pixels; RGB; 5MB

## RESULTS OF TRAIANBLE SEGMENTATION

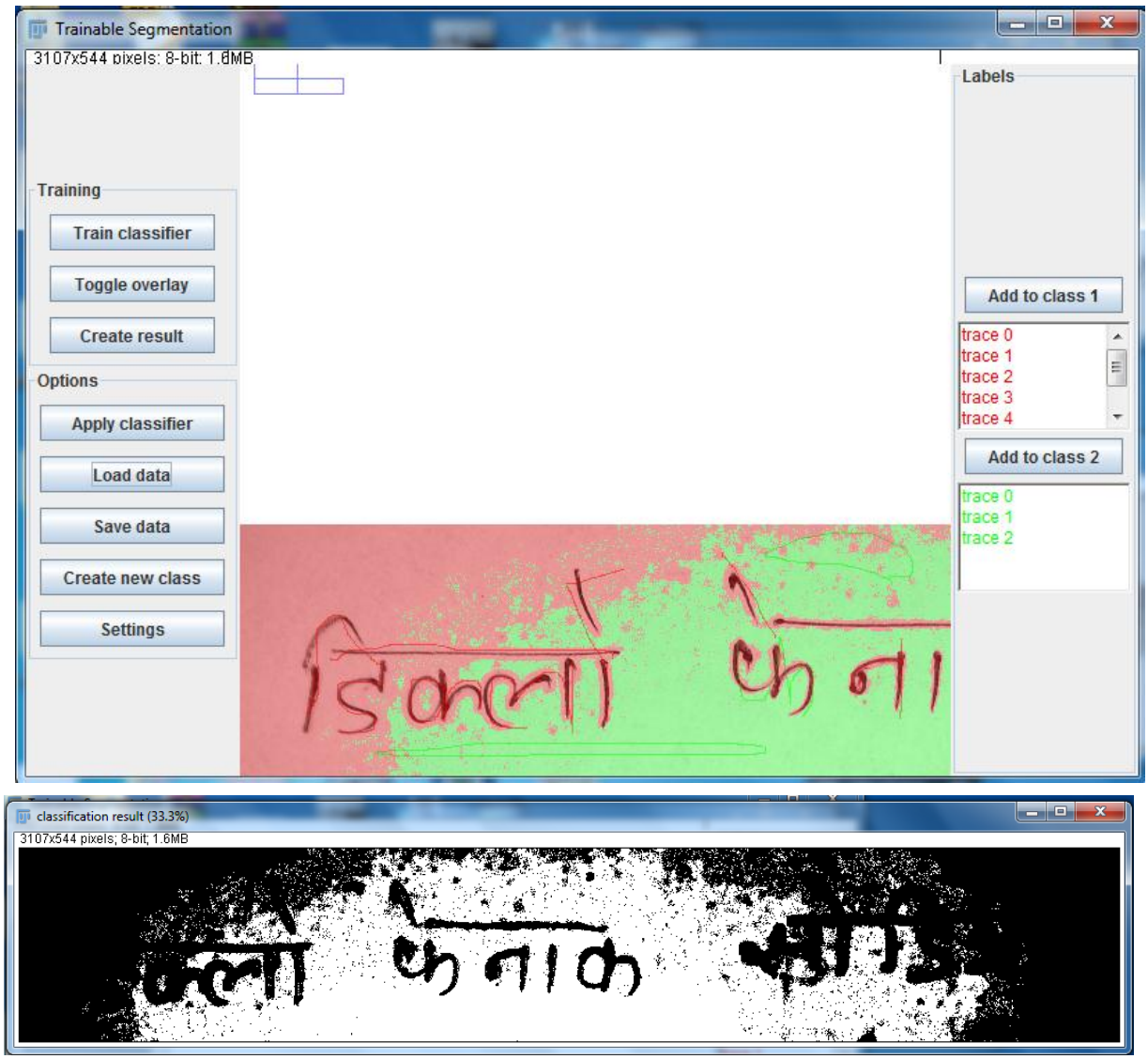
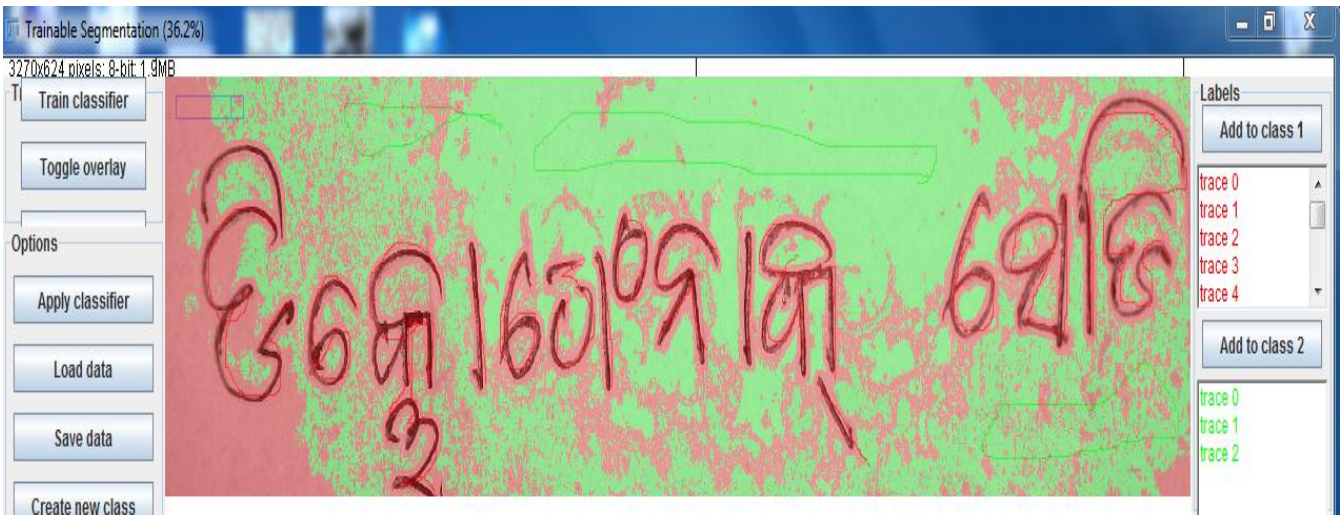
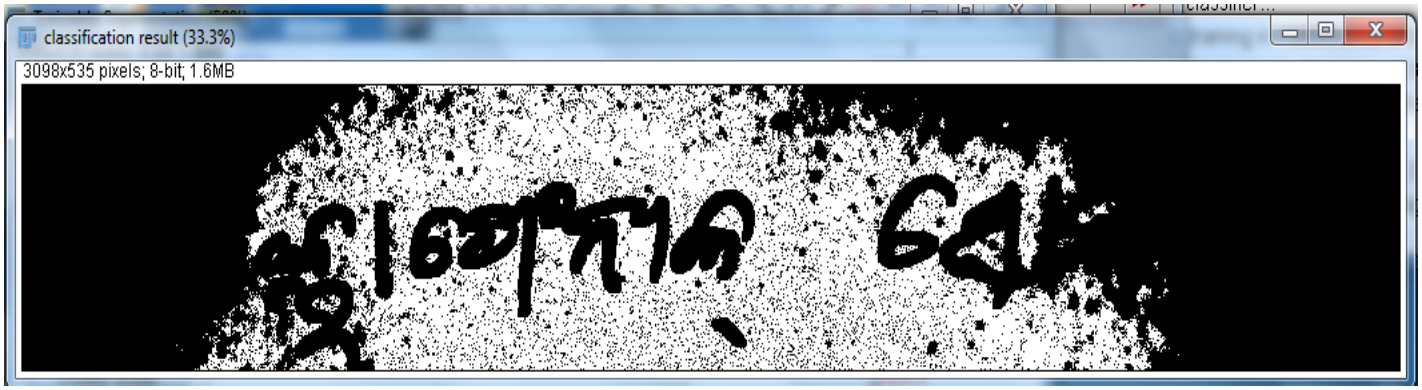



**Fig 3.8 Results obtained after applying train classifier on hindi-word**



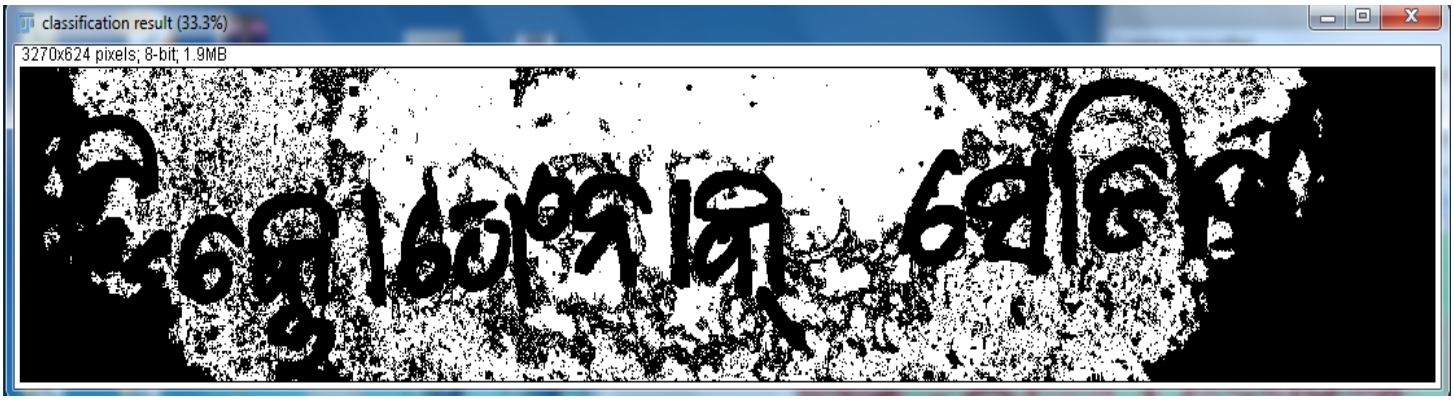
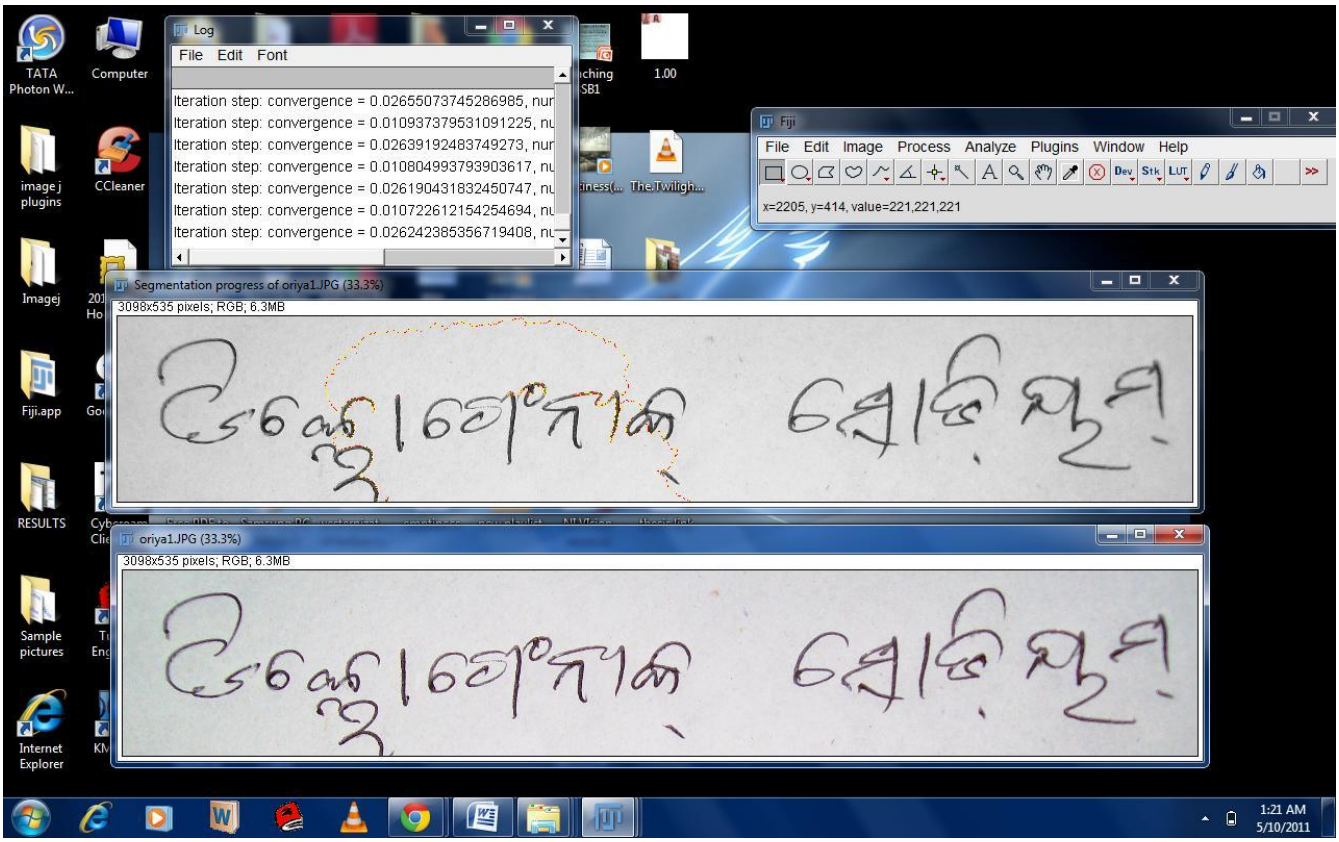




**fig 3.9 results obtained after applying train classifier on oriya word**


Log
File Edit Font
Iteration step: convergence = 0.02655073745286985, nur
Iteration step: convergence = 0.010937379531091225, nu
Iteration step: convergence = 0.02639192483749273, nur
Iteration step: convergence = 0.010804993793903617, nu
Iteration step: convergence = 0.026190431832450747, nu
Iteration step: convergence = 0.010722612154254694, nu
Iteration step: convergence = 0.026242385356719408, nu
Fiji
File Edit Image Process Analyze Plugins Window Help
x=2205, y=414, value=221,221,221
Segmentation progress of oriya1.JPG (33.3%)
3098x535 pixels; RGB; 6.3MB
oriya1.JPG (33.3%)
3098x535 pixels; RGB; 6.3MB
1:21 AM
5/10/2011

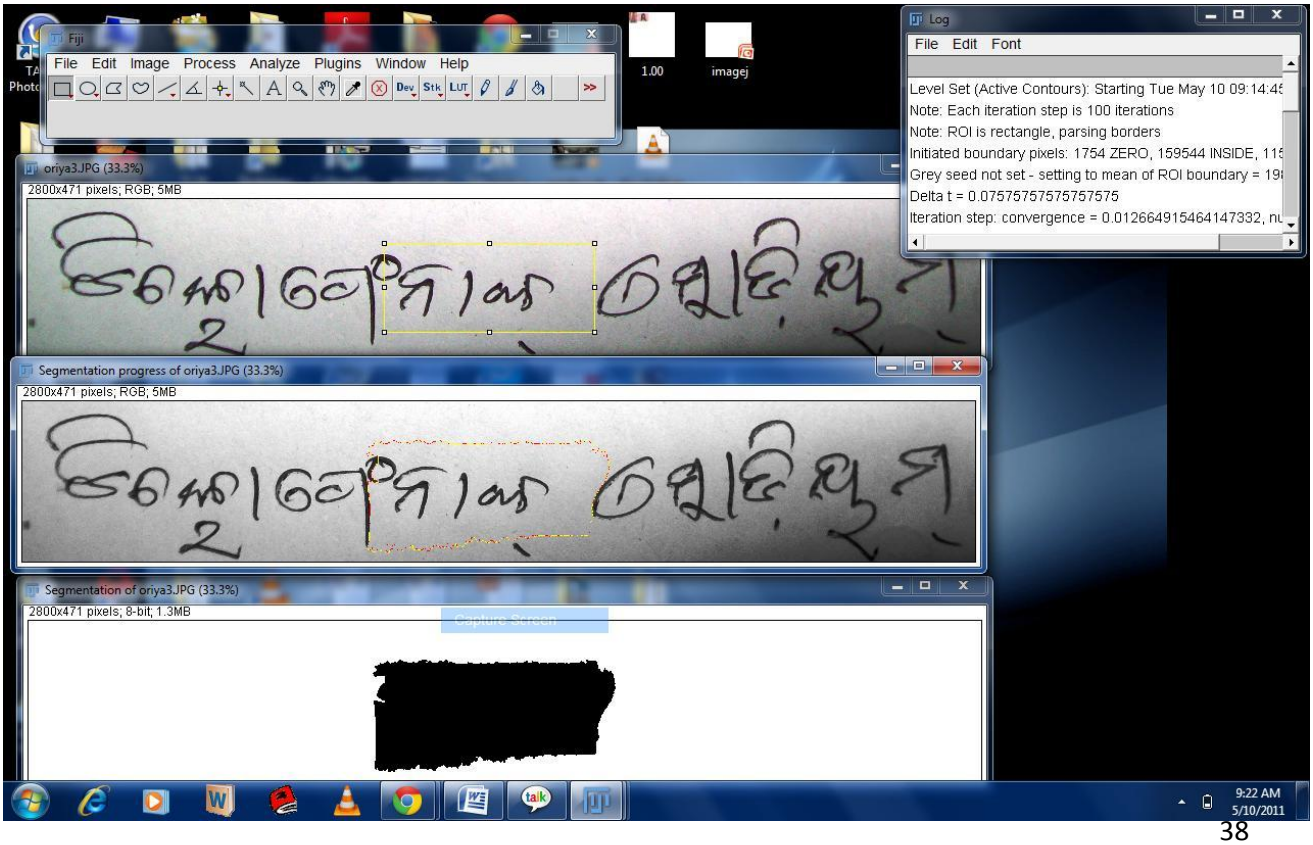

Fiji
File Edit Image Process Analyze Plugins Window Help
Log
File Edit Font
Level Set (Active Contours): Starting Tue May 10 09:14:45
Note: Each iteration step is 100 iterations
Note: ROI is rectangle, parsing borders
Initiated boundary pixels: 1754 ZERO, 159544 INSIDE, 11
Grey seed not set - setting to mean of ROI boundary = 19
Delta t = 0.07575757575757575
Iteration step: convergence = 0.012664915464147332, nu
oriya3.JPG (33.3%)
2800x471 pixels; RGB; 5MB
Segmentation progress of oriya3.JPG (33.3%)
2800x471 pixels; RGB; 5MB
Segmentation of oriya3.JPG (33.3%)
2800x471 pixels; 8-bit; 1.3MB
9:22 AM
5/10/2011

**Fig 3.10 Result of level set algorithm applied on oriya word**

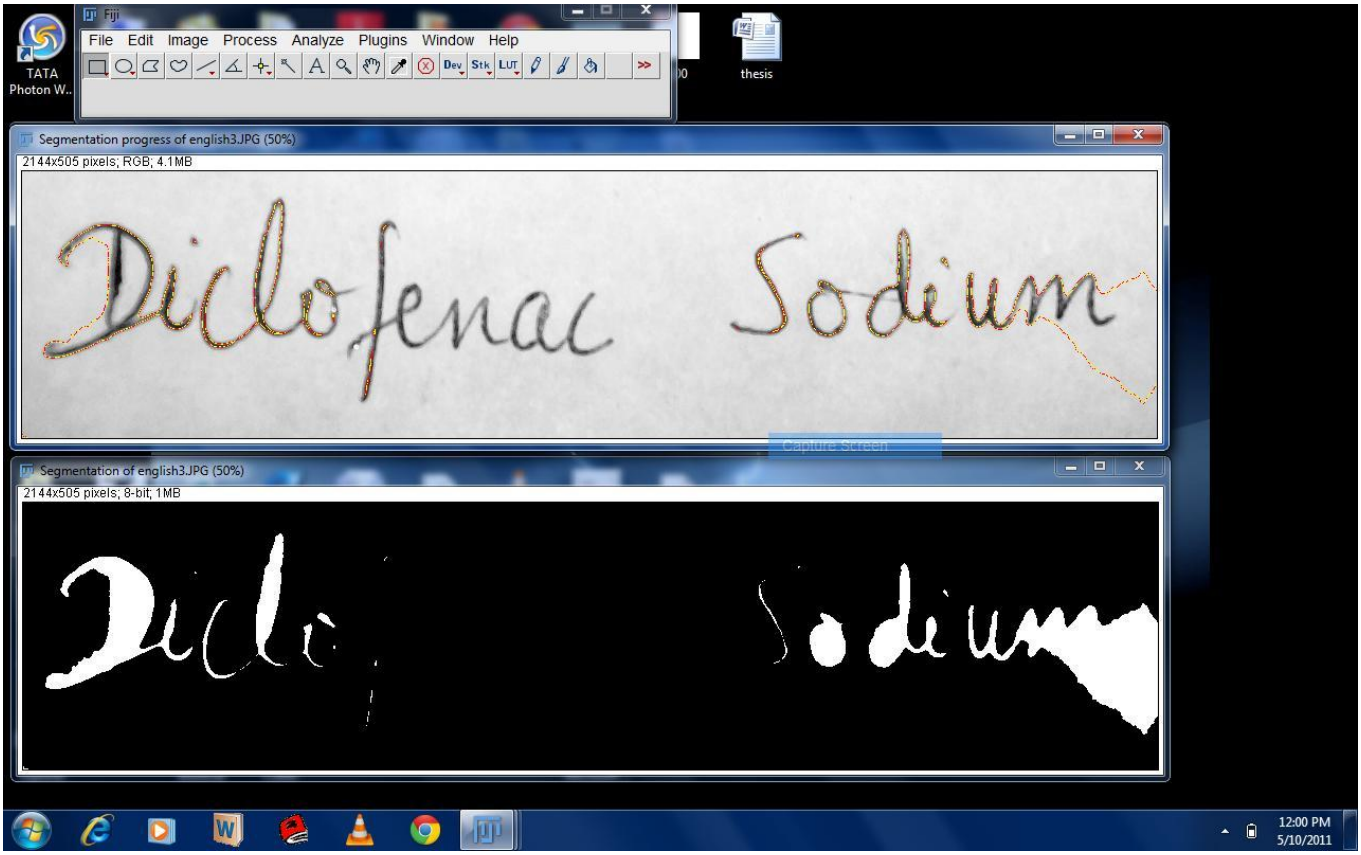



**fig 3.10 results obtained by level set algorithm on English word**

# CHAPTER4

# CONCLUSION

## 4.1 CONCLUSION

The objective was to address the problem of automatic writer identification and Verification from offline scanned images of handwriting, for which we used the orientation and curvature information in writing which is extracted by segmentation and Computing a set of features from writing contours at different levels of observation.at last we observed that watershed segmentation is best for segmenting words because it segments each alphabet into highlighted and compact shape irrespective of pattern of writing which make it easy for recognition from standard data base.

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[2]http://pacific.mpi-cbg.de/wiki/index.php/Level_Sets)

[3]http://en.wikipedia.org/wiki/Edge_detection

[4]http://www.pages.drexel.edu/~weg22/edge.html

[5] http://pacific.mpi-cbg.de/wiki/index.php/Simple_Neurite_Tracer

[6] http://iisit.org/Vol6/IISITv6p877-886Khiyal593.pdf

[7] http://cmm.ensmp.fr/~beucher/wtshed.html

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[14]S.Hewavitharana,H. C. Fernando,**A Two Stage Classification Approach to TamilHandwriting Recognition,**Department of Computer Science,University of Colombo,Colombo 03, Sri Lanka.

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